STRUCTURE AND WORKING OF SCIENCE MODELS 1997

Structure and Working of Science Models

1997

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Preface

In the present 10+2 pattern of education, the learning of science has been made compulsory for the first ten years of school education. This has been done in order to develop certain well-defined abilities and skills such as the spirit of inquiry, creativity, objectivity, courage to question and aesthetic sensibility. A formal system of education, however well-conceived, is not adequate to achieve the desired goals of science education. Rigid and theoretical lessons of the formal system, inadequately supplemented by demonstrations and experiements do not provide much opportunity to the naturally curious child to indulge in the joys and fun of scientific investigation.

The programme of 'Out of School Science Activities' helps, to a great extent, to achieve the desired goals of science education by supplementing the formal system. Science exhibitions offer an opportunity to the students to express and exchange their creative ideas. At the same time, students learn the methods of science. While preparing for the exhibition, the student gets an opportunity to develop his/her problem-solving skills and creative abilities.

The Jawaharlal Nehru National Science Exhibition for Children is an annual function with a large number of students and teachers participating from all over India. It is the culmination of series of exhibitions organized at zonal, district, state and regional levels.

The present brochure includes write-ups of a few exhibits selected for display in the twenty-fourth Jawaharlal Nehru National Science Exhibition being organized in Gurgaon (Haryana). These are the write-ups of exhibits selected from those adjudged the best in the state level exhibitions held in 1996-1997 all over the country. It is a companion of another publication, *List of Exhibits*, which contains the titles and synopses of almost all the exhibits invited to participate in the Jawaharlal Nehru National Science Exhibition, 1997. While editing the write-ups, efforts have been made to retain the original expression and language of the children as much as possible. It is hoped that this brochure will motivate and help more children to particpate in the science exhibition.

The write-ups contained in this brochure were selected and edited by Prof. M. Chandra, Dr. K.M. Pant, Dr. Brahm Prakash, Dr. J.S. Gill, Dr. V.P. Srivastava, Shri R. Joshi and Dr. B.K. Sharma of the Department of Education in Science and Mathematics, National Council of Educational Research and Training (NCERT). I appreciate their sincere efforts. I specially thank Dr. B.K. Sharma for coordinating this work in 1997and seeing this manuscript through the press. I also thank the Publication Division, NCERT, for its cooperation in bringing out this publication and for the excellent production quality.

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Professor and Head
Department of Education in
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National Council of Educational
Research and Training
New Delhi

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1

Card Security System

Student : Neeraj Arora St. Lukes Senior Secondary School
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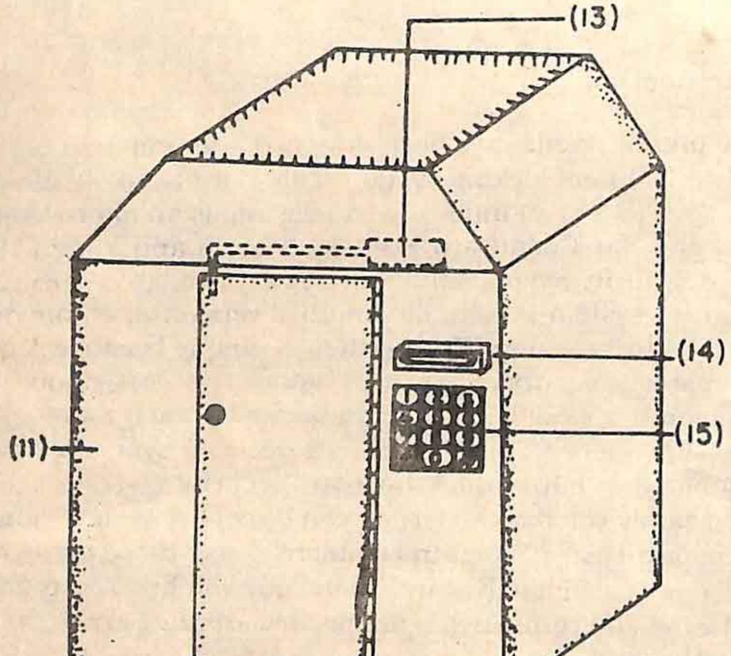
Introduction

The present model has been designed and prepared to provide a foolproof locking system. This Card Security System i.e. the C.S.S is an innovative device and is an improvement over the Bar-Code Card Security System and Punch Hole Card Security Systems that are already available. This card security system is actually another version of component card security system. This system is unique because unlike the barcode security systems, it is not very costly and with some minor modification it can be made much more effective even more than the bar-code security systems. When compared with the punch-hole card security systems, C.S.S. is certainly safer as the former can be copied while it cannot be copied easily. When in commercial use these cards can be laser sealed like ICs and so nobody will be able to make out what the components are or how are they arranged inside the card.

Construction and Working

This system consists of a very simple computer. A computer, in a broad sense, means a device or system that takes command in the form of an analog, electric or digital pulses and executes a function given to it or programmed in it. This computer takes command in the form of electric impulses. Once the impulse is produced by the card i.e. only the precise card is registered in the computer, the computer shifts to a mode that has been named as the mode of Self Reliance. In this mode, the computer gets activated and stays activated because it, in itself, through a looping circuit, produces the same electric impulses as are produced by the card in the beginning. These electric impulses keep the relay (output relay) in the circuit energised till the deactivating switch of the computer is pressed or operated to break the loop of the computer, thus deenergising the delay. Thus, the out-put relay acts as a switch to provide electric current or electricity to the electro-magnet that operates the latch (that locks and opens the door) through a system of levers.



The figures shows the schematic arrangement of the CSS. The items shown in the figure are

11. Object (it can be House, cup-board, or locker etc.)
12. Door

13. The circuit(Enclosed in a case).
14. Slot (Where card is to be inserted).
15. Key Pad

Operations

The door is normally closed and latched with the lever of item 13 as shown.

To open the door

1st Step : One has to insert the CSS 'CARD' in the slot (item 14). This will partially activate the circuit. (A card looking like a 'bank credit card' which is coded and provided to the owner of the object).

2nd Step : A precoded and known number (comprising of 3 digits) is to be pressed on the keypad (Item 15) in a particular sequence only. e.g. the number chosen is 921. This number 921 is to be pressed in its sequence nine, two, one only. In case a different number or the wrong sequence is chosen, the system will activate an audible sound alarm. This would draw the attention of the owner against any attempt by an unauthorized person to open the lock. However, pressing the digits of the number in a correct sequence will completely activate the circuit, and door latch will get lifted, allowing the owner to open the door.

To close the door

1st Step : Just push the door in close position.

2nd Step : Push the reset switch on keypad (Item 15). The door is locked.

Security Features

1. The lock is doubly secured, which can be opened only by a person who possesses both, (i) the **'CARD'** provided for a particular door and (ii) the knowledge of the coded number that too in a correct sequence. Apart from the above, one has to know about reset operation as well.

Special Features

This computer does not consist of any costly micro-chip or any IC. This factor makes it cheaper in cost. Moreover, this circuit is so simple that along with CDSS (card and digit security system) it can be fabricated in a 36 pin IC.

Applications

This system can be used on items needing high level of safety and security of the contents like Bank Lockers, Cup boards in industries (Housing valuables), automobile vehicles and main doors at home etc.

2

Revolving Concave Reflector Type Solar Cooker

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Mohit Kohli
Teacher : Jaswant Singh

Govt. Model Senior
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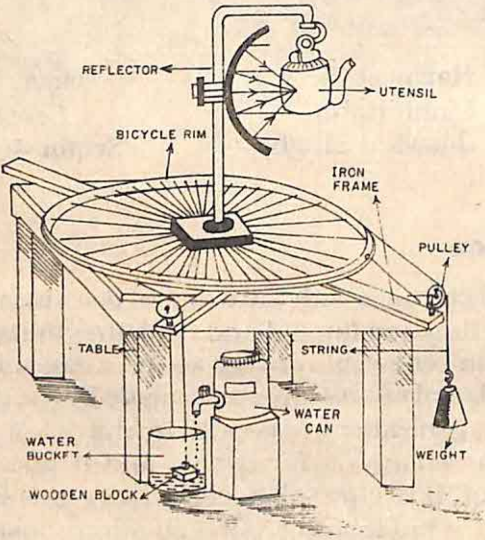
Sector 46 Chandigarh

Introduction

We cannot keep pace with the demand of conventional energy sources as they are limited and depleting in nature. Future hopes are on renewable energy sources like solar, wind and bioenergy. Lot of efforts have been made by the governmental and social organizations to popularize the use of solar cookers as the solar energy is renewable and it does not pollute environment. Box-type solar cooker has received acceptance to some extent but it has certain limitations. Inside a properly designed box-type cooker the temperature may go upto 100°C or even up to 140°C, so it can not be used for frying and baking purposes. Secondly, the direction of the reflector of solar cooker has be changed from time to time to keep it facing the sun. These problems have been solved to some extent in the revolving concave reflector type cooker. The reflector revolves according to the movement of the sun and in this way it always faces the sun. Further, in the concave reflector the sun rays get concentrated at the focus and high temperature is obtained which is sufficient for baking and frying purposes.

Scientific Principle

A concave reflector focuses sun light at one place (focus of the reflector) and therefore solar energy falling on the surface of the mirror gets concentrated over a small area, giving rise to a high temperature. The heat so obtained can be used for frying or baking purposes. The reflector revolves with the help of a mechanical arrangement based on the upward force of water and the force of gravity. The speed of rotation of the reflector has been adjusted in such a manner that it always faces the sun.



Materials Used

1. A concave reflector
2. A bicycle rim fixed on an iron stand
3. Two small pulleys with a weight, a piece of wood and a piece of string
4. A bucket of water and a water can fitted with a tap.

Construction and Working

The concave reflector is designed by arranging a number of small sized plane mirrors on a curved (concave) surface. A bicycle rim is fixed horizontally on an iron stand which is kept on a wooden table. The reflector is fitted on a vertical stand fixed along the axis of the rim through its centre such that the reflector moves along with the rotating rim. A thin string is passed around the rim. One end of this string is passed through a pulley and then attached to a piece of wood. This wooden piece is made to float in water kept in a bucket. The other end of the string is passed over another pulley with a weight suspended from it. A can of water with a tap is placed adjacent to the bucket of water as shown in the figure.

The solar cooker is kept in the sun light. The utensil for cooking food is kept at the focus of concave reflector. The light rays get concentrated by the concave reflector and heat up the utensil to a high temperature sufficient for cooking or frying. Now the tap fixed on the can is opened such that drops of water fall in the bucket of water placed below. The piece of wood floating in water experiences an upward force due to buoyancy of water. The weight attached to the other end of the string moves down due to the force of gravity. This movement of the string rotates the rim of the bicycle as well as the reflector fixed on it. The speed of flow of water from the tap can be so adjusted that the rim and the reflector rotate with the same speed as the apparent position of the sun changes in the sky. Thus, the reflector is always directed towards the sun. In this way the reflector automatically moves in a manner that it always faces the sun to collect maximum amount of solar energy.

Applications

1. High temperature is produced in this type of solar cooker and it can be used for baking and frying purposes.
2. Reflector always faces the sun due to its movement.
3. This type of reflector can be used where high temperature is required.

3

Automatic Motor Controller

Students : Sheetal Kumari Govt. Girls High School, Garhi
Anu Kumari Udhampur, Jammu
Teachers : Pawan Kishore Jandial Jammu and Kashmir
Sanmati Gupta

Introduction

We are celebrating *Golden Jubilee* of our independence but still we are far behind from the target of population stability. The population is on the increase and we are ready to lead the world in this field. As a result of increase in population, there is growing threat that we may have to face energy crisis. We are wasting our resources on which we depend for our survival. To avoid such energy crisis, an attempt has been made to design an Automatic Motor Controller to reduce wastage of water and electricity, for providing comfort and convenience to the people.

Scientific Principle

In this device IC-555 acts as a *Sensor* which is used for on-off purposes for water pump through 6V-9V Relay.

Materials Used

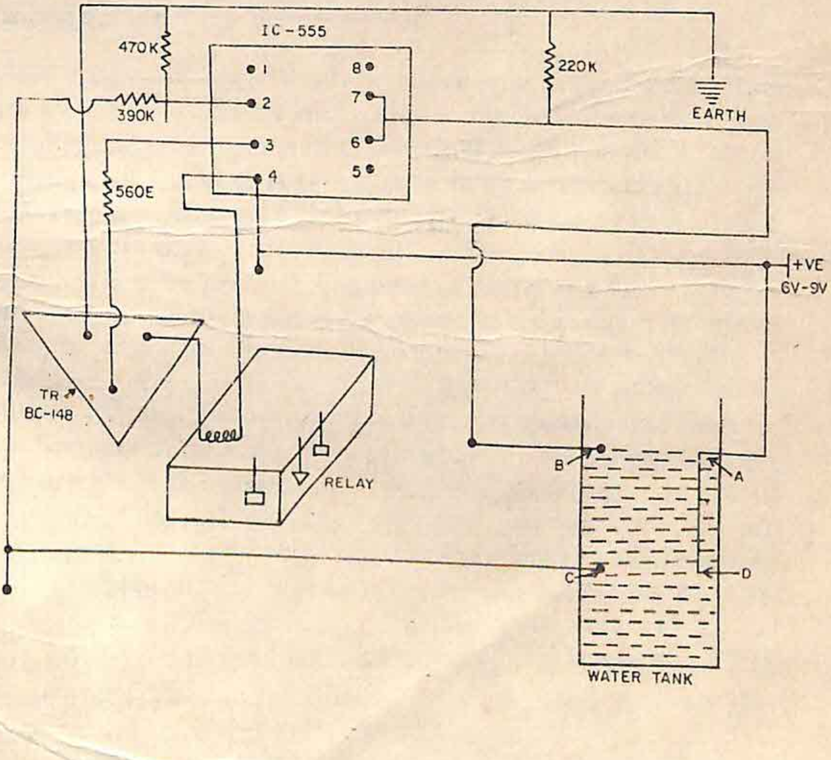
1. One IC - 555
2. One IC - case
3. One Tr - BC 148
4. Resistors R_1 R_2 560 KΩ, 0.5W each

Resistors R_3, R_4 470 KΩ, 0.5W each

5. One Relay 6V - 9V
6. Connecting wires

Construction and Working

A relay is used for on-off purposes for the water-pump. Whenever water-level is between A and C, Sensor IC-555 sends signal to the controller Tr, BC-148. As a result, supply to the relay from the controller starts, the water-pump lifts the water. When water-level reaches between A and B, again sensor sends signal to the controller Tr. BC-148, from which supply to the relay gets cuts off and the motor of the pump goes off.



Advantages

1. It can be used with domestic water pumps, automatic lifting of water to overhead tanks.
2. It reduces wear and tear of the pump. As the motor, if operated for long durations continuously, gets heated up resulting in its wear and tear.
3. No big tank is required to store water because whatever would be the capacity, the tank will remain filled, thereby saving the cost.
4. It reduces inconvenience and saves time required to switch on and switch off the motor.
5. This device is low cost, costing about Rs. 50/- only.

4

Pest Indicator

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Teacher : S. Lal

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West Siang
Arunachal Pradesh

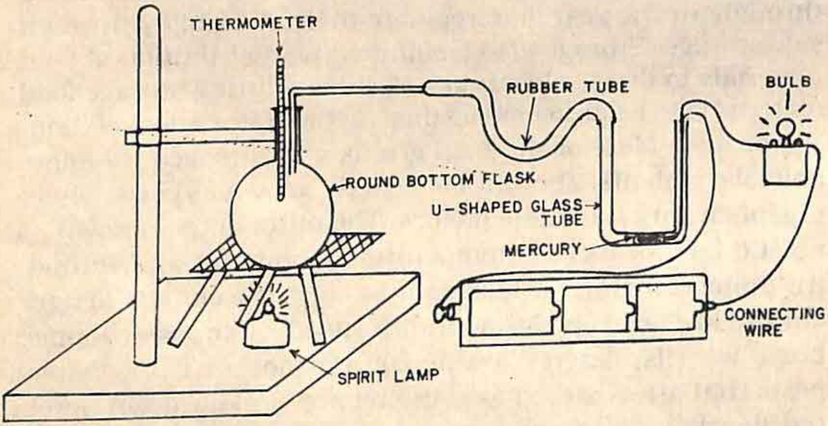
Introduction

Most crops are harvested only once in a year. That is they are available in plenty only during a particular period. The simplest way to ensure that seasonal foods can be obtained throughout the year is to regulate their availability through safe storage. Storage also facilitates the distribution of food materials to distant locations. However, during storage food material is to be protected against all possible causes of damage or loss. Most of the food grains are damaged by micro animals or plants. They are collectively known as pests. These organisms are the biotic factors. The other actors known as abiotic factors include temperature, moisture and humidity. Some common pests encountered in the context of agriculture are arthropodes including insects like grass hopper, bugs, weevils, caterpillars and grain moths. The common pests that affect stored food grains are weevils, grain bores, red fleurbeettle, grain moths, almond moth, guindy bug etc. Due to attach of these pests the quality as well as the quantity of foodgrains are affected. Taste is also changed by these pests. The labour and money of the farmers go in vain, if we do not save the foodgrains.

In Arunachal Pradesh, the food products are infected by pests. These infected food products are harmful to our health and affect food value also. To ensure the attack of pests, a device known as Granery Pest Indicator which can be used to find out infestation of pests in foodgrains has been developed.

Materials Used

1. Connecting wires
2. Round bottom flask
3. Mercury
4. U-shaped glass tube
5. Rubber tube
6. Cork
7. Spirit lamp
8. Bulb
9. Battery



Working Principle

High moisture content as well as high temperature accelerate the growth of moulds and pests. This may in turn cause the temperature of the stored grain to go upto 66°C and raise its moisture content from 14% to 18%. This is known as Dry and Wet Heating or Damp grain Heating. When these organisms increase, the rate of respiration increases which increases the temperature of the store. Due to increase in temperature, the air filled in the flask expands and pushes the mercury column. Consequently the mercury column completes the circuit and the bulb (Indicator) glows, which indicates the presence of pests in the granery.

Advantages

1. It is a very low cost device
2. It is portable. It can be carried very easily from one place to other
3. It is safe to use.
4. It is pollution free
5. It can be very easily handled by an illiterate farmer.

5

Hexane Pump

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Baby Shemina C

Teachers : Valsamma Mathew
Abdurehiman P.A.

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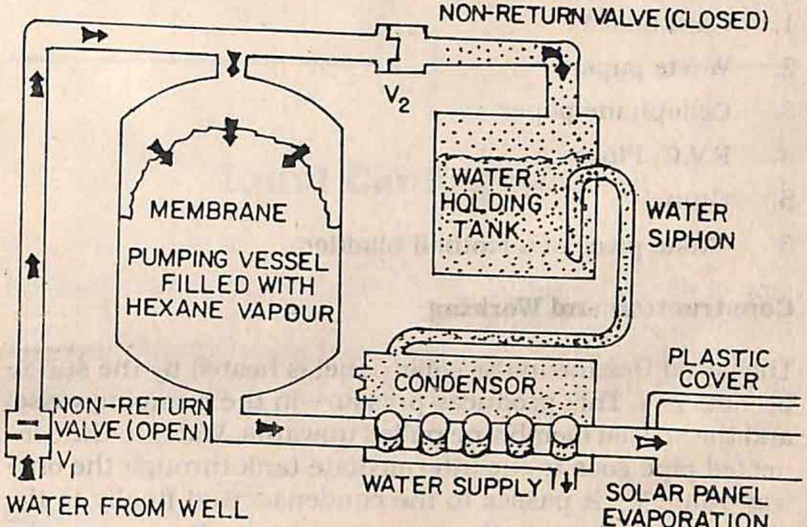
Introduction

For millions of people in the third world the shortage of water and carrying it daily from source to the point of use is time consuming and extremely difficult task. For this, here is a simple and cheap solution — a small solar powered pump — a Hexane pump. It is cheaper to run with little maintenance than conventional systems which are based on fossil fueled engines. It could revolutionise the pumping system throughout the world.

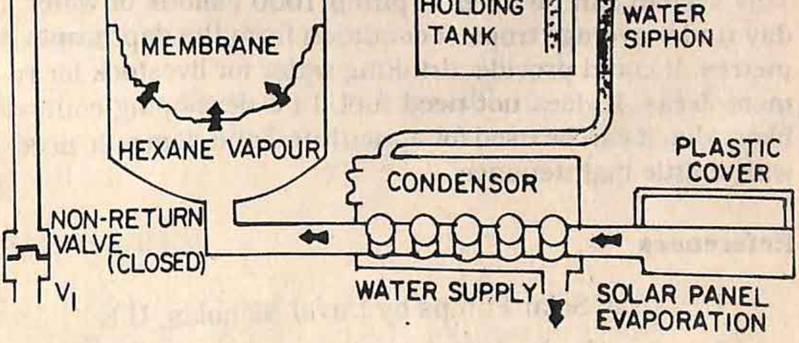
Scientific Principle

The panel of 2 m^2 contains liquid hexane, the boiling point of which is 68-69°C. It is alternatively heated upto its boiling point by the Sun. It becomes vapour. The vapour cooled by the water being pumped so that it becomes liquid. Due to the vaporisation of hexane, pressure increases. It allows a special type of membrane to push water in the pipe to the tank. At the same time the vapour condenses in the condenser tank. Hence the pressure decreases and the water is pulled out of the well.

JUST COMMENCING CONDENSE CYCLE



COMMENCING DISCHARGE CYCLE



Materials Used

1. Card boards
2. Waste paper
3. Cellophane paper
4. P.V.C. Pipes
5. Gum
6. Waste piece of a football bladder.

Construction and Working

The liquid Hexane in the solar panel is heated by the sun to become gas. This produces pressure in the pumping vessel and the special membrane pulled upwards. Water in the connected pipe goes to the intermediate tank through the one-way value V_2. It passes to the condenser and finally to the storage tank through the one-way valve V_2. It passes to the condenser and finally to the storage tank through the siphon. While water passes through the condenser, gaseous hexane gets condensed to liquid form. Consequently, volume and pressure decrease and the special membrane comes downwards. This produces a sucking force at the valve V_1 and water is lifted. The liquid hexane again changes to vapour at the solar panel and the process goes on.

Applications

This system can be used to pump 1000 gallons of water a day under average tropical condition from the depth upto 8 metres. It could provide drinking water for livestock for remote areas. It does not need fuel. In a developing country like India, it can be used for agricultural and domestic needs with a little maintenance.

References

1. Gray Solar Pumps by David Nicholas, U.K.
2. Spectrum, British Science news.

6

Rural Cardiograph

Student : Tapas Dhul

Teacher : Amiya Baron Bhowmick

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Introduction

Now-a-days heart disease especially heart attack is a common problem among the age group in fifties. Modern medicines and computer science have revolutionized the treatment of heart problems. However, arrangement of modern instruments for recording E.C.G. especially in rural areas is still no satisfactory. The *Rural Cardiograph*, a low cost cardiograph, is a device for recording undulations of heart beats at low cost for the poor villagers who have no scope for getting facility of E.C.G. and have no capacity to pay for costly E.C.G. prior to their medical treatment.

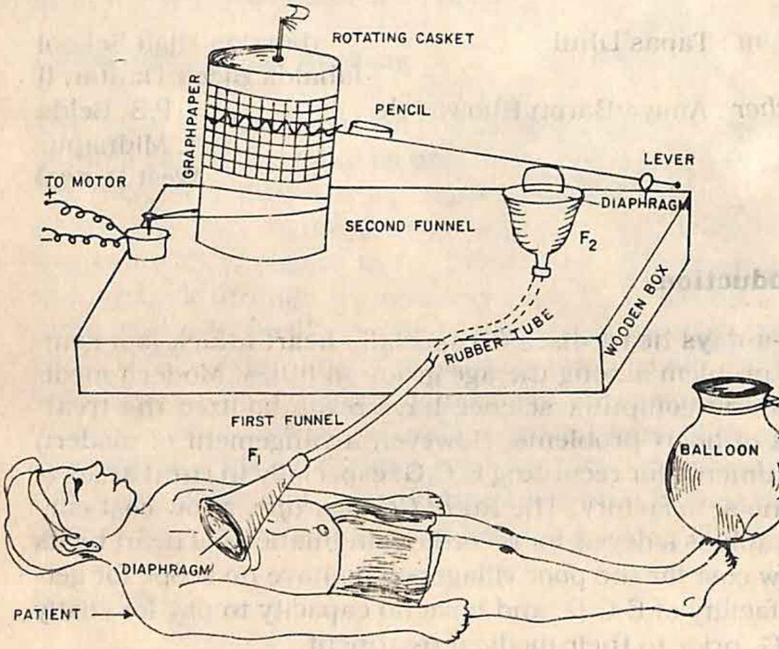
Scientific Principle

Heart beats vibrate a pointed pencil fitted on a diaphragm. The tip of the pencil traces undulations on a moving sheet of graph paper.

Materials Used

1. A few pieces of plywood/Tea box to make a box of capacity 30 cm × 20 cm × 10 cm and iron nails
2. A cylindrical basket of medium size (Amul spray type)

3. A pointed thin pencil
4. Two small glass funnels of equal size
5. A few pieces of rubber balloon to make diaphragm over the funnels
6. A light metal-wire (hard) to make a lever
7. A small electric motor (6V to 9V) with eliminator and
8. Rolls of graph papers to cover the curved surface of the casket.



Construction and Working

A portable wooden box (30 cm × 20 cm × 10 cm) is constructed with two/three holes on the upper surface at suitable distances.

The ends of the two funnels are connected tightly with the two ends of a rubber tube (of 2 or 3 metres). Two sheets of balloon are then stretched over the mouths of the two funnels. One funnel (F_2) is placed on one hole and the second funnel connected with F_2 by rubber tube will be pressed on the chest of a patient. Two holes are made in the central parts of the two flat surfaces of a cylindrical basket (Amul spray type).

A hard metal stick is vertically fitted on the upper surface of the wooden box with nut bolt arrangement. The cylinder is placed on the box (at the second hole) vertically with the hard metal stick(as its vertical axis) about which the cylinder may rotate. A small electric motor is duly connected with a belt to the cylinders.

A pillar of small size is kept vertical on the upper surface of the wooden box to the right hand corner. A metal wire taken from umbrella will be fitted with a small pillar to make the metal wire as lever. The metal wire lever ends with a pointed pencil which will touch the curved surface of the rotating cylinder covered with rolls of graph papers. The lever rests on the diaphragm of the second funnel lightly with proper sensitivity to move up and down with the vibration of the diaphragm connected with the first funnel.

When the first funnel is pressed on the chest of a human being the heart beats are transmitted through the connecting pipes and will move the pointed pencil at the tip of the lever up and down.It makes traces of undulations on the graph paper.

Application

If the first funnel is pressed on the chest of a patient, the vibrating pencil draws undulations on the graph paper rolled on the rotating cylinder. Such a cardiograph will help the doctors for their use during investigation of heart diseases. The cardiograph uses available materials and costs a little. This method of preparing cardiograph has been applied on the aged teachers of our school and the relevant cardiographs have been compared with the relevant E.C.G. and results of the cardiographs from our instrument and the E.C.Gs from the hospital have been verified and found to be correct.

7

Chitosan—The Versatile Waste

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Introduction

Turning wastes into useful value added products is gaining importance in recent years. One such very useful waste generated by sea-food industry is Chitosan. It is present in tough shells of prawns and crabs. The exoskeletons of most of the shellfishes and also the cell walls of many fungi contain chitin which is nothing but a polymer of a compound of chitosan.

Availability of chitosans in useful forms and its unique chemical and biological characteristics have found many diverse uses. The chemical is commercially produced from wastes generated during shrimp and crab processing. Thanks to chitosan's versatility, the nearly one billion tonnes of chitin produced every year by the sea-food industries has found good use in food processing, drugs and pharmaceuticals and other industries.

Scientific Principle

The present model suggests an innovative method for safe disposal of the waste, such as exoskeleton of prawns generated in a prawn processing plant. The waste is depolymerized and converted into an extremely useful compound called chitosan. This compound has got numerous applications, in almost all the industries.

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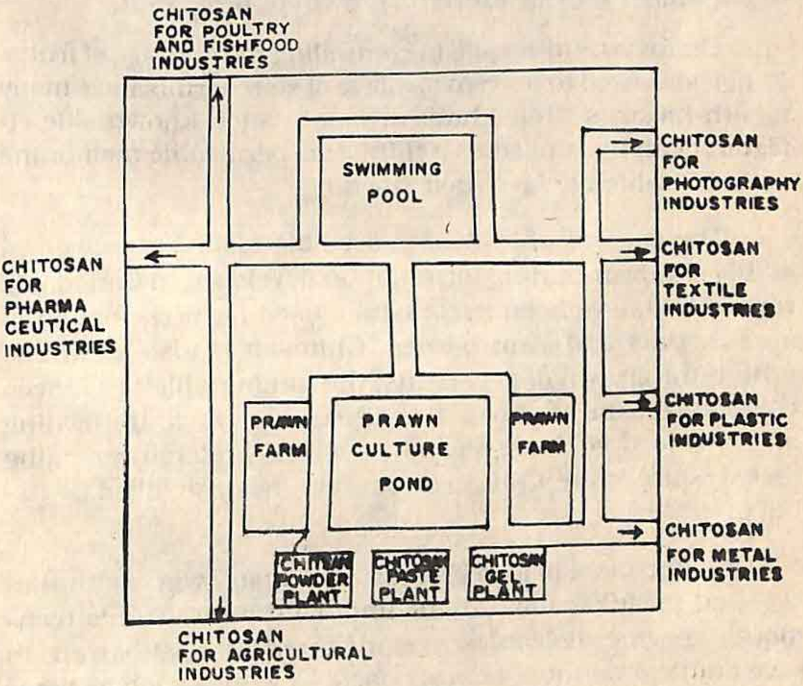
Materials Used

1. Hard-board ply
2. Thermocole
3. Drawing sheets
4. Card board
5. Pins
6. Fevicol


CHITOSAN FOR POULTRY AND FISHFOOD INDUSTRIES
SWIMMING POOL
CHITOSAN FOR PHOTOGRAPHY INDUSTRIES
CHITOSAN FOR PHARMA CEUTICAL INDUSTRIES
CHITOSAN FOR TEXTILE INDUSTRIES
CHITOSAN FOR PLASTIC INDUSTRIES
PRAWN FARM
PRAWN CULTURE POND
PRAWN FARM
CHITOSAN FOR METAL INDUSTRIES
CHITIN POWDER PLANT
CHITOSAN PASTE PLANT
CHITOSAN GEL PLANT
CHITOSAN FOR AGRICULTURAL INDUSTRIES

Construction and Working

The exhibit is a miniature model of a chitosan manufacturing plant. The model displays a Prawn Farm where prawn culture is done and prawns are processed as well as packed. The processed prawns are sent to the market while the disposal of waste left behind in the form of chitin creates environmental problems. The exhibit shows how this waste can be converted into a useful product in a chitosan synthesis plant. The waste is broken down to chitosan with the help of enzymes. Chitosan so obtained is collected in the form of powder, paste and gel.

Applications

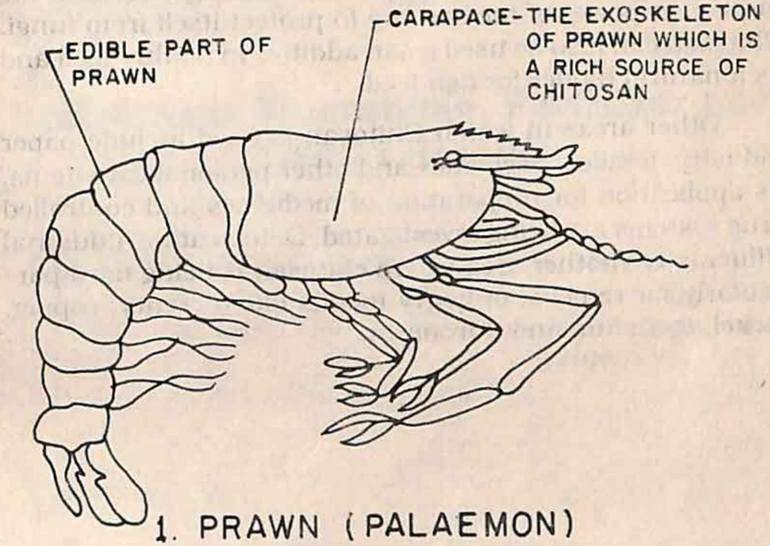
A major user of chitosan is the food industry. The industry uses polysaccharides like chitosan and starch to alter properties of food items. Chitosan, for instance, has been used for preserving fruits and vegetables. Tomatoes treated with chitosan can be kept fresh for a longer time. Chitosan added to cucumber pickles prevents growth of fungi in it.

Chitosan is also used in controlling the spoilage of fruits. Fungicides used to prevent spoilage of stored fruits have many health hazards while chitosan has to such known side effects. It can be applied as a thin semi-permeable membrane on fruits which delays their ripening.

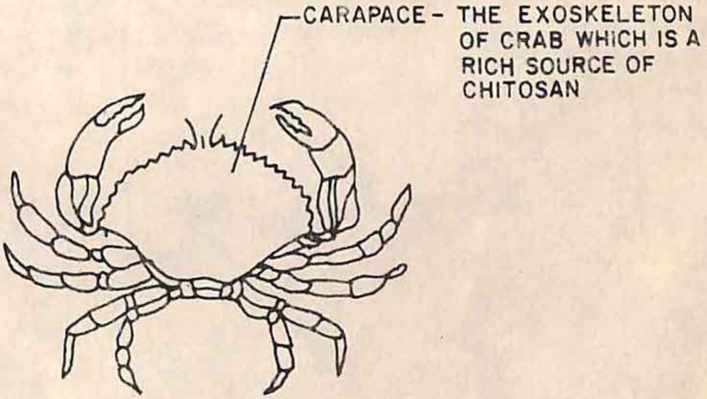
The coating of chitosan is edible also. Nutrisave, an edible chitosan coating formulation developed in Canada, is reported to have been successfully used for preservation of apples, peas and strawberries. Chitosan is also known to inhibit the growth of aspergilus, the fungus which produces the deadly toxin, aflatoxin. It is also used as an antibrowning agent in food such as vegetables which undergo browning on exposure to air. Coffee extracts can be deacidified by using chitosan.

Another area in food processing industry where chitosan is found useful is the enzyme immobilization. In this technique, enzyme molecules are anchored on a substrate to save on the amount of enzyme used. Enzymes such as beta-galactosidase, glucose isomerase lusozyme, and proteases used extensively in food processing industry could be immobilized on chitosan gel.

In agriculture, chitosan has multiple uses. It is mainly used, of course, as a useful manure. Chitosan can also be used to control plant pests, especially for biological control of pathogens. For instance chitosan applied to the Eusarium (a plant pathugeh) fungus infected soil stimulates the growth of micro organisms that kill the fungus.


EDIBLE PART OF PRAWN
CARAPACE-THE EXOSKELETON OF PRAWN WHICH IS A RICH SOURCE OF CHITOSAN

1. PRAWN (PALAEMON)


CARAPACE - THE EXOSKELETON OF CRAB WHICH IS A RICH SOURCE OF CHITOSAN

2. CRABS (A CRUSTAL CLAN)

Chitosan solution sprayed on tomato plants eliminates tobacco mosaic virus infection in them. On the other hand, pea plants treated with chitosan produce an excess of phytoalexin, a fungal growth inhibitor used by plants in defence against fungal attacks. The environmental protection agency of the U.S. has permitted coating of wheat seeds with chitosan to increase crop yields. The coating increases the protection power of the seeding to protect itself from fungi. Chitosan can also be used as an additive in poultry feed and as a natural binder for fish feed.

Other areas in which Chitosan is used include paper industry, textiles, cosmetics and other personal care items. Its application for preparation of medicines and controlled drug systems are being investigated. Detoxicating industrial effluents is another area where chitosan is being used particularly for removal of heavy metals like mercury, copper, nickel, cadmium and duronium.

8

Low Cost Insecticide, Fertilizer and Water Sprayer

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Teacher : Padmanabh R. Lotlikar

Introduction

Farming is the main occupation for about three-fourth of our country's population. Yet, we need to import food grains to support our population. The reasons are too many and too complex to warrant consideration here. However, one of the reasons is that our farmers still make use of traditional methods which are more time consuming and less cost-effective than modern techniques. For instance, manual spraying of insecticides, fertilizers and water are still practised widely in our country. But, this method fails to ensure uniform distribution of the materials sprayed, thereby adversely affecting the production.

In order to overcome this difficulty, a Low Cost Insecticide, Fertilizer and Water Sprayer has been devised. This devise is designed to ensure uniform distribution of the materials sprayed. This helps to improve both the quality and the quantity of the crop without enhancing the cost.

Scientific Principle

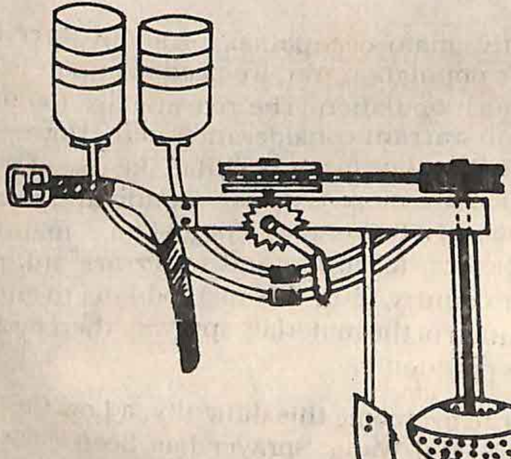
(a) Ball bearings reduce friction

(b) Pulleys of different sizes increase the speed

(c) Centrifugal force helps the uniform spraying of insecticides fertilizers and water.

Materials Used

1. Handle
2. Gear system
3. Belt
4. Two pulleys
5. Wooden base
6. Tin
7. P.V.C. pipe
8. Two palmolein oil bottles
9. Saline tube



Construction and Working

Two palmolein oil bottles are fitted with saline tubes at their bottom (Fig.) A gear-system is fitted at one end of a rectangular wooden board and a metallic shaft is fitted on the other end. A metallic tin with holes at its bottom is fixed at the end of the shaft. A big pulley is attached to the gear-system with the help of a handle and a small pulley is attached to the shaft. The two pulleys are connected by means of a leather belt. The drip tube from the bottles passes over the board into the tin through P.V.C. pipes.

The liquid to be sprayed is poured into the bottles and is allowed to flow through the tubes into the tin. When the handle is rotated, the pulley gets rotated which, in turn, rotates the tin. As the speed of rotation increases, a greater centrifugal force acts on the liquid and it is sprayed out on to the fields.

Applications

1. We can use the apparatus to spray insecticides, fertilizers, water or any other material in liquid form.
2. The liquid is sprayed uniformly on a given area.
3. The apparatus is portable and it can be carried by keeping the board in one's hand and the bottles in a bag on one's back.
4. It can be easily operated by any person.
5. Its cost is very low. It can be prepared by incurring an expenditure of about Rs. 100/- only.

9

Human Waste into Human Asset

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Teachers : Mythili Senthil Kumar
Senthil Kumar

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Vidyalaya
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Introduction

In this decade degradation of waste material has become a severe problem. In the train also there is limitless rush. In long distance journey travellers have to stay even for 3 to 4 days in the train. For the passengers, then the train becomes a house during the period of journey. Since 60 to 70 people have to stay in a comparatively congested area, if cleanliness is not maintained, it becomes cumbersome and inconvenient to travel. The areas which require more attention for cleanliness are toilet blocks and railway tracks. Disposing off human waste is therefore an essential aspect in maintaining the cleanliness on the railway tracks, in the train, and on the railway station. Human waste when used as an ingredient to biogas plant can serve this purpose perfectly.

Description

A system is developed to collect all human waste in trains and utilise it for producing biogas from biogas plants situated on railway stations. The sewerage system consists of drainage pipe lines, storage tanks, connecting pipes and biogas plant. The toilet outlets from 4 toilet blocks of each bogie will be opened in a pipeline centrally placed under the train. This pipeline will be opened in the storage tanks placed under the front and the last bogies. The toilet outlets of these end bogies will be opened in the two pipelines placed under the toilet blocks. These pipes will in turn be connected to the centrally located sewerage pipeline. A non-returning valve is provided at the junction of the main sewerage pipeline and storage tank to control the reverse flow of faecal matter back into the pipeline. Flexible PVC pipes will be used for joining the pipeline under the bogies. The storage tanks will be opened in the underground drainage system from the platform ends to biogas plant.

Working

When the train is moving, human excreta will pass through the main sewerage pipeline and will be collected in the storage tanks. The sewerage tanks will be emptied in the drainage pipeline of biogas plants when the train halts at the railway station. The system will be cleaned by passing water forcefully at the destination or starting point.

Materials Used

The human waste is utilized for producing the energy through a biogas plant. Hence two biogas plants will have to be established at the front and back end of the platform on main stations. In the toilets a W.C. outlet will be connected to the waste carrying pipeline through 's' strap bent pipe. This will have to be done for all the toilets in the train to maintain the water level and to prevent reverse flow of the waste from pipe line to W.C.

Design

The design of the system is based on the following data and assumptions.

1. No. of bogies in a train = 15
2. Water content capacity per bogie = 500 litres

3. Total water contents in 15 bogies = 500 × 15
= 7500 × 1000 cc
= 7500000 cc
4. Capacity of storage tank = 7500000 cc
5. Length of the bogie = 75 feet
= 75 × 30 cm
= 2250 cm
6. Number of storage tanks = 4
7. Radius of storage tank = SQ (Capacity/PIE × 4 × H)
= SQ (8000000 × 7/22 × 4 × 2205)
= 16.73 cm
or 17 cm

Applications

Biogas produced from the system can be used for electrification on the railway station, railway canteen, and in houses in surrounding area. Thus it would be an alternate energy source and energy conservation is achieved for the benefit of mankind.

10

Automatic and Demand Fish Feeder

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Teacher :

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Introduction

Artificial feeding of the fish is an important and time consuming job for fish culture and aquarium maintenance. The proposed automatic and demand fish feeder is designed with a special device for feeding fish automatically on demand i.e. whenever the fish feels hungry. This can be conveniently used in aquariums and fish culture ponds to:

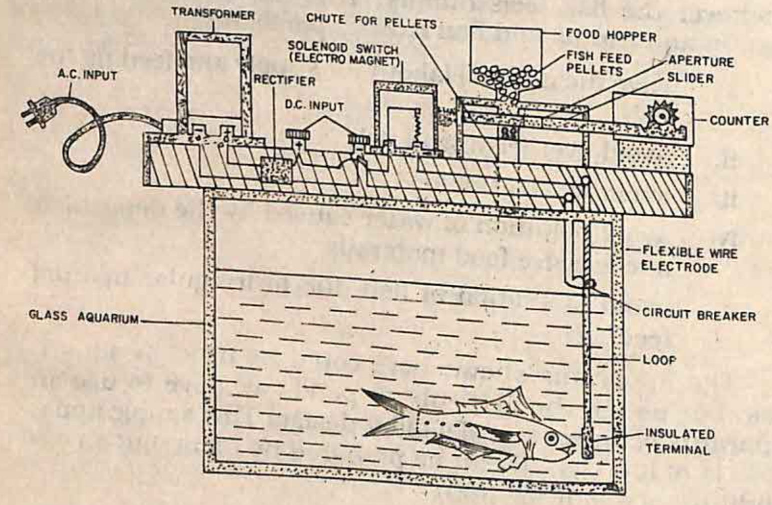
i. save the manual labour for supply and feeding the fish
ii. avoid over feeding of fish
iii. avoid wastage of food
iv. avoid pollution of water caused by the deposition of excessive food materials
v. avoid starvation of fish due to irregular manual feeding.

The apparatus shown here could be used in aquariums. For use in the fish culture ponds we have to use an apparatus of bigger size of similar design. This simple apparatus is of low cost. It can be prepared by incurring an expenditure of about Rs. 300/-.

Construction and Working

The apparatus consists of wooden board which bears a food hopper, an electromagnet (solenoid switch) which works with a transformer or D.C. (battery), one digital counter and wooden slider controlling the outlet hole of the food hopper. The food pellets kept in the hopper are allowed to drop through the small outlet hole of adjustable size according to the amount of food desired to be dropped in a single opening of the outlet hole. The outlet hole of the hopper can be closed or opened through a slider which can be pushed forward and backward by means of an electromagnet attached to it and which works with the help of a transformer placed on the wooden or D.C. when connected with a battery.

A short electric wire having a loop at the bottom is connected with the positive (+) terminal. Another wire connected with the negative (-ve) terminal of the electric circuit passes through the loop of the first wire and extend downward with a terminal knob for immersion into the water. The lower part of the wire below the loop is insulated for immersion into the water. The two wires connecting to the (+ve) and (-ve) terminals serve as the circuit breaker electrodes of the feeder. When the fish in the water touches the terminal the electric circuit is completed. Subsequently, the electromagnet operates by pushing back the slider and the hole of the slider is put in the same line with the outlet of the hopper



and the food is allowed to drop. The electric circuit is broken again when the fish releases the knob and the slider have been pushed forward closing the outlet hole of the hopper. The operation could be repeated as long as the fish intends to get more food. Everytime the slider moves backward, it is recorded by a counter attached to the feeder.

Application

The fish feeder can be conveniently used commercially and economically for supply of artificial food to the fishes in the aquarium as well as the fish culture ponds with a simple and low cost device.

Thus, we can supply the food only when the fish intends to feed by touching the knob. The quality and quantity of food supply can be controlled automatically without wastage of food and labour.

Besides, this apparatus could be used to:

1. *Study the learning capacity of fishes*
   - (i) study the time taken by different fish species to acquaint with this mechanism of feeding.
   - (ii) study the attraction of the fishes to different colours of the terminal knob.
2. *Study the feeding behaviour of fishes e.g.*
   - (i) time of feeding in a day.
   - (ii) amount of food consumed per day.
3. *Study the nutrition of fishes e.g.*
   - (i) quantity of food consumed, which can be calculated from the growth rate.
   - (ii) preference of food etc.

References

J W Adron. A design for Automatic fish feeder for Experimental fish, J. Cons. Int. Explor. Mer. Vol. 34, No.2, Pp.300-305, Compenhagan (1972).

11

Cheap Refrigerator

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Teacher : Satbant Kaur

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Punjab

Introduction

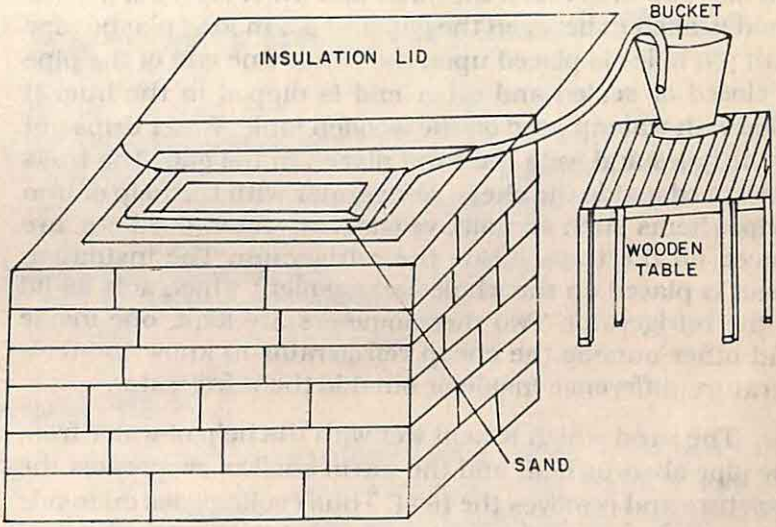
The present model of cheap refrigerator requires no technical skills, no electric connections and no covered space. It can be made anywhere even in the open space, with easily available cheap materials. It is very easy to construct such type of a cheap refrigerator.

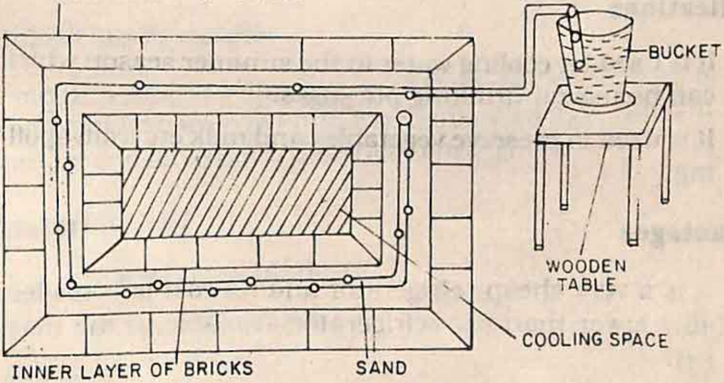
Evaporation is a process in which liquid water is converted into its vapours. As water evaporates from a warm surface, it absorbs heat and thus cools the surface. This process takes place continuously at the surface and moisture is given off through the pores of the sand and cools the contents of the refrigerator.

Materials Used

1. 130-140 bricks
2. Insulation sheet for the lid of the refrigerator.
3. Two trays
4. Two small bags of sand
5. Plastic pipe (about 5 m long with small pin holes for dripping water on the sand)

6. Plastic bucket or tin (about 5 litres capacity) containing water
7. A wooden table
8. Two thermometers
9. Iron strips.





Construction and Working

First of all a layer of bricks is arranged on the ground in a rectangular shape. On this layer six rows of 5 bricks are arranged length wise and of 4 bricks breadthwise. It will act as outer portion of the cheap refrigerator. In the inner side of this, six rows in the same manner are arranged bricks with a 4 bricks length wise and 3 bricks breadthwise. There is a 2.5" gap in between the outer and inner layers of bricks. Sand is filled in between the gap and a 5 m long plastic pipe with pin holes is placed upon the sand. One end of the pipe is closed or sealed and other end is dipped in the bucket filled with water placed on the wooden table. Water drips out of the holes and wets the sand placed in the gap. The trays are placed inside the cheap refrigerator with the help of iron strips. Items such as milk, vegetables, water, curd etc. are placed on the trays inside the refrigerator. The insulation sheet is placed on the whole arrangement which acts as lid of the refrigerator. Two thermometers are kept, one inside and other outside the cheap refrigerator to know the temperature difference inside or outside the refrigerator.

The sand which is kept wet with the help of water from the pipe absorbs heat and the warm surface evaporates the moisture and removes the heat. Thus cooling goes on inside the inner portion of the refrigerator and the contents placed inside the cheap refrigerator get cooled.

Applications

1. It is used for cooling water in the summer season which can be use for drinking purposes.
2. It is used to preserve vegetables and milk etc from spoiling.

Advantages

1. It is a very cheap refrigerator and its cost is considerably lower than the refrigerator available in the market.
2. It is easy to construct such type of a refrigerator.
3. It saves electricity as it utilizes solar energy for its functioning.

12

Electricity from Busy Traffic Roads

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Teachers : Joginder Singh
Japnam Singh

Introduction

The present exhibit attempts to get energy from non-conventional source i.e. electricity from busy traffic roads. In this exhibit electrical energy is produced on a large scale from roads with busy traffic on without causing any harm to the vehicles of their tyres.

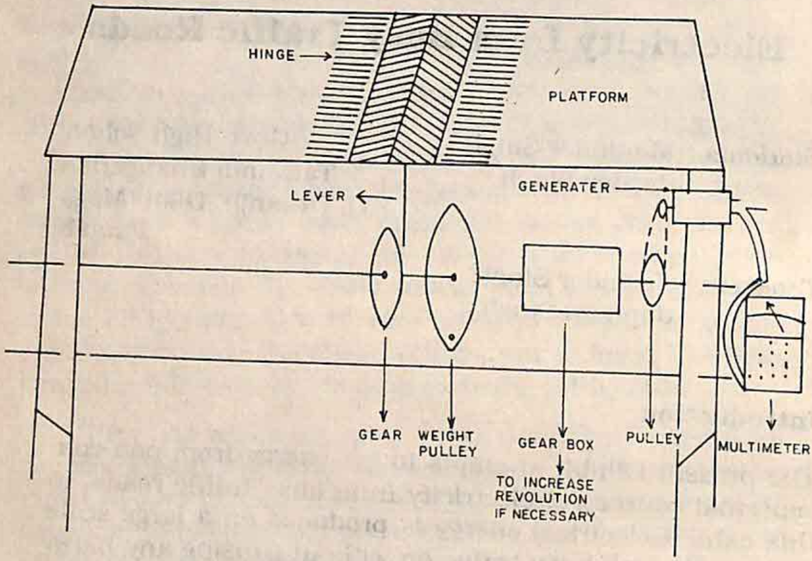
Scientific Principle

Potential and Kinetic energy of the vehicles moving on the road can be converted into mechanical energy which in turn can be converted into electrical energy.

Material Used

1. A flat wooden platform
2. a hinge of large size
3. A shaft
4. A gear attached to the axle
5. Flywheel
6. A pulley fixed on the axle

7. An electric generator
8. A belt connecting the pulley and the generator
9. An indicator or multimeter to show the production of electricity.



Construction and Working

A slit is formed in the long wooden platform. One large hinge is fixed over this ridge-slit in such away that the hinge is free to move — contraction and expansionwise. A long lever is attached to the centre of the hinge in such a way that with the movement of the hinge (upward and downward) the lever attached to it also moves up and down. Just behind this lever, on the lower side is a gear. This gear is attached to an axle in horizontal position, such that when the gear rotates, the axle also rotates. A Flywheel is attached to the axle which helps in setting momentum and to keep the axle rotating for a long time. This axle is fixed with a pulley at one side which also rotates with the rotation of the axle. An electric generator is fixed on one side of the frame on which the wooden platform is fixed. This generator is connected with the pulley of the axle with a belt.

When any toy vehicle is passed over the platform it presses the hinge downwards and the lever attached to the hinge also moves downwards and hits the gear fixed to the axle below the lever. This way the axle is set in a rotatory motion and the flywheel attached to the axle gains momentum and the axle keeps on rotating for a long time. In the mean time the hinge moves upwards due to the springs fixed below its hump. When the next vehicle passes over this so called road (wooden platform) the hinge again moves downwards, pushes the gear and the axle keeps on rotating. The pulley attached to the axle is in a continuous rotatory motion which, in turn, rotates the pulley of the generator (fixed to the frame) with the help of a belt. The generator produces electricity continuously. As the number of vehicles moving over the road increases, rotation of the axle increases along with an increase in the electricity produced.

Applications

The working model, if constructed on a large scale and installed on the main busy traffic roads, can be applied in production of electricity on a large scale. It will be ecofriendly and having no loss to the vehicles moving on the road. This way we can produce electrical energy, saving our conventional fuels and also producing no pollution.

13

Extraction of Nicotine Through Cigarette Sucker

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Sudeep Pradhan
Teacher : Sebastian P. J.

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Introduction

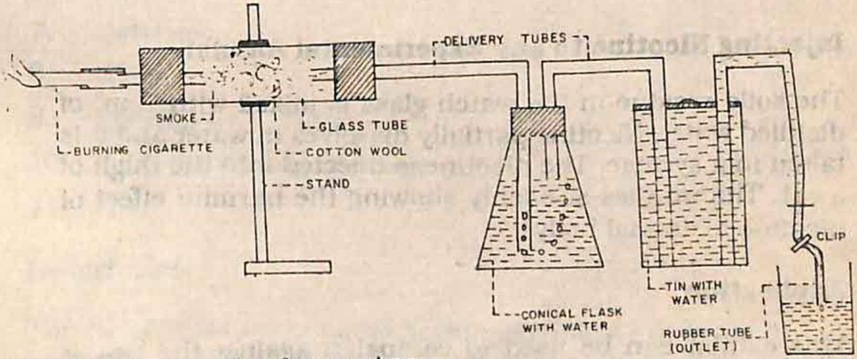
Use of tobacco in any form is undoubtedly injurious to health. Even though there are various ways of using tobacco, smoking is considered as the most universal method of tobacco use. Why is smoking harmful? For several reasons: Smoking is not merely an expensive luxury; it plays a definite part in lowering a persons resistance to disease. Heavy smokers die five to ten years earlier than non-smokers. In most cases, the trouble is due to some condition of the heart or blood vessels. Another important factor is cancer of the lungs. Yes, a person can save money by not smoking but for more consequential, he saves health and vitality.

Poisons in Tobacco

There are eighteen different poisons in tobacco. Some of these attack the delicate membranes of the wind pipe. Others enter the blood stream and interfere with its normal circulation throughout the body. The most prominent is the tar, which contains carcinogenic or cancer producing substances. As a poison it is second only to cyanides in its destructive effect on the human body. Extracts of these substances are used by scientists to produce cancer in mice and other experimental animals.

Materials Used

1. Glass tube 20 cm long and 2 cm diameter - 1 No.
2. Delivery tubes - 3 Nos.
3. Conical flask - 1 No.
4. Rubber corks - 4 Nos.
5. Empty tin - 1 Nos
6. Vaseline - 20 g.
7. Cotton wool - 10g.
8. Cigarette - 1 Packet
9. Rubber tube- 1 m.
10. Diethyl ether - 50 ml
11. Distilled water - 5 ml
12. Syringe and needle - 1 No.
13. Match box - 1 no.
14. Rat - 1 No.
15. Watch glass - 1 No.



Setting up the Apparatus

Some cotton wool is pushed into the centre of the glass tube and it is closed with rubber corks at both ends. Through one of the corks passes a small glass tube which is connected with a small rubber tube. One delivery tube connects the other end of the glass tube with a conical flask which is half filled with water. The other delivery tube connects the conical flask with a tin, completely filled with water. One rubber tube starts from the tin(reservoir) and it is closed with a clip at the other end.

Working

All the connections are made air tight. One cigarette is partially inserted inside the short rubber tube at the free end of the glass tube. The clip is removed and water is allowed to drip down from the tin through the rubber tube. The cigarette is lighted. Due to suction, the cigarette burns properly and the smoke is drawn through the cotton wool kept inside the glass tube automatically. In the same way six to ten cigarettes are allowed to burn and the deposited nicotine is extracted from the cotton wool.

Extraction of Nicotine

The cotton wool is removed from the glass tube and it is kept in a beaker. Some diethyl ether is poured over it and is squeezed properly. The yellow coloured liquid which is a solution of nicotine in ether is left like that for few minutes. Ether being a volatile liquid evaporates leaving behind a yellow residue of nicotine in the watch glass.

Injecting Nicotine to any Experimental Animal

The solid residue in the watch glass is mixed with $2cm^3$ of distilled water. Nicotine partially dissolves in water and it is taken in a syringe. The nicotine is injected into the thigh of a rat. The rat dies suddenly showing the harmful effect of nicotine to animal body.

Application

This exhibit can be used to campaign against the use of tobacco in any form.

Reference

Tobacco and Your Health: The smoking controversy by **Harold** S Diehl, M.D.

14

Common Balance for the Blind

Student : Romita Th. Sacred Heart High School
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Teacher : Sadanandan C.P. Ukhrul (Manipur)

Materials Used

The materials required for making this balance are :

1. O (zero) balance
2. cardboard
3. I.C. (Integrated Circuit)No.(NE 555, 9615),
4. Capacitor
5. Resistors
6. Switch
7. Batteries
8. Wires,
9. Speaker
10. Tube containing mercury
11. Pins

Description

The circuits contain resistors, capacitor, and I.C. When the circuit is closed, the electricity passing through the resistors produces a small alternating current which causes the speaker to make sound. Three different open circuits are placed in three different places, of the balance which will be closed by the mercury at different positions. The three resistances used in 3 different circuits are different which will vary the current. Due to variation of current, different sounds are produced in the speaker.

Working Principle

When the balance turns to the left side, the mercury in the tube will close the left circuit and electricity flows through the circuit and a sound is produced. When it turns to right side, the mercury will close another circuit which will make another sound due to the variation of resistance from the former. When two sides are equal, third circuit will be closed which will produce a different sound other than the former two. Recognising these sounds, a blind persons can understand the weighing process.

Applications

It should be very useful for the blind. It is very cheap and can be easily operated.

Instant Pasteurization Plant

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Teacher : Raman Bansal

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Introduction

The working model is developed to pasteurize milk (within 10 minutes) to prolong the keeping quality of milk by killing bacteria using heat radiations generated by electric power using nichrome element. This arrangement is very useful for domestic purposes, as it saves the milk from being spoiled. It is a very handy device which not only provides pasteurized milk but also produces hot water as a by-product for cleaning utensils in the kitchen. The cost of pasteurization of one litre of milk is hardly Re. 0.50 excluding the hot water available for domestic purpose.

Scientific Principle

(i) When milk is heated to 65°C or 70°C for 30 minutes or 15 minutes respectively and then cooled rapidly to below 10°C, the bacterium causing diseases like tuberculosis, typhoid and Brucellosis are killed.

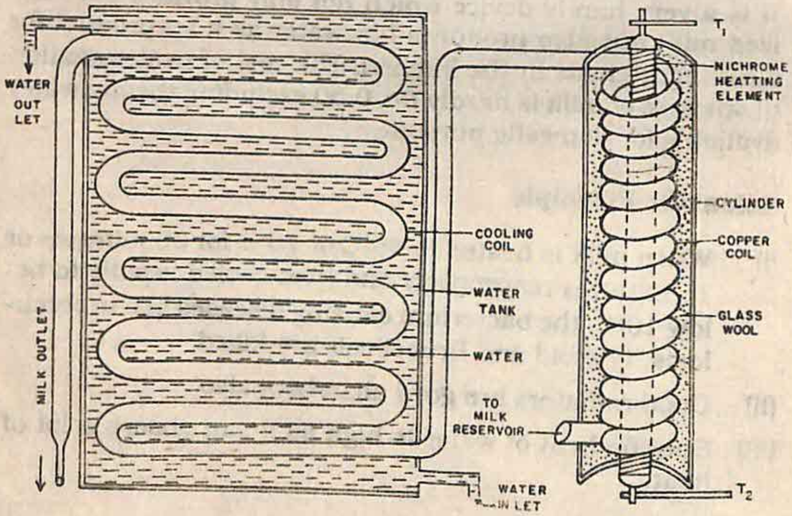
(ii) Good radiators are good absorbers also.

(iii) Specific heat of water is high so it can absorb a lot of heat.

Materials Used

1. A wooden box of size 60 cm × 60 cm × 15 cm

2. A glass sheat of size 60 cm × 60 cm
3. Copper coil of inner diameter 5 cm and length 25 cm, connecting clips.
4. Heating element of 2 KW
5. Water tank of size 30 cm × 25 cm × 7.5 cm
6. Milk reservoir of capacity one litre made up of aluminium
7. Milk collecting bottle
8. Glass wool
9. Metal cylinder covering copper coil
10. Electric wire
11. Fuse
12. Suitable Electric Shoe
13. Thermometer
14. Screw and other small necessary items.



Construction and Working

Heating Coil

It is made of 4mm thick copper having a spherical shape of diameter 5 cm and length 25 cm. One end of the coil is fitted at the bottom of the milk reservoir and other end is connected with the cooling coil. The coil is enclosed by a 2000 watt heating element which works on 220 AC voltage (Rod shape element). The coil and the heater are enclosed in a cylinder, 7.5 cm in diameter, and the space between coil and cylinder is packed with glass wool to minimise the loss of heat energy from the coil's external surface.

Temperature Control

Manually a thermometer inserted in the outlet of milk from heating coil reads the temperature. A thermostat can also be used for maintaining the temperature of the milk between 65°C to 70°C.

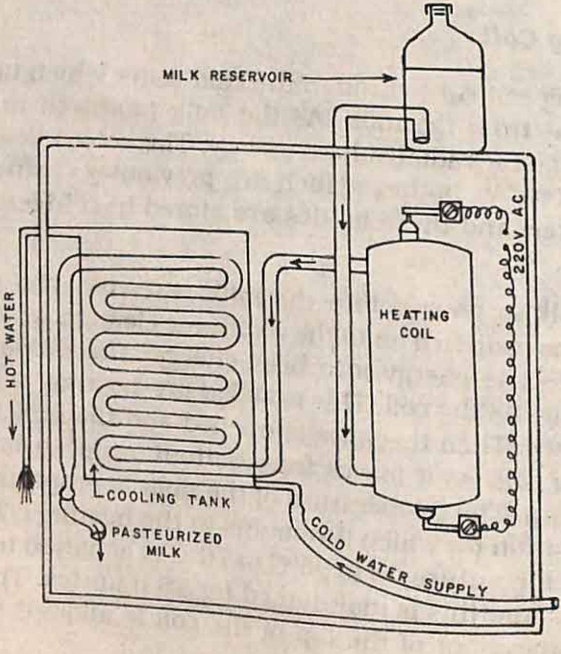
Cooling Coil

A zig zag coil runs through the cold water which takes up the heat from the milk. As the milk moves through the copper coil it radiates heat energy. The cooled down milk is collected in bottles (which are previously cleaned with hot water) and these bottles are stored in refrigerator for storage.

Milk is poured into the milk reservoir. The electric supply is switched on to the nichrome element which converts electric energy into heat energy. The radiant heat energy heats the coil. This is called pre-heating. It is done for 30 see. Then the valve is opened and the milk rushes into the coil. As it moves from bottom to upwards it gets heated up. The temperature of the milk is proportional to the duration for which it remains in the heating coil. Normally temperature up to 65°C to 70°C is achieved in 2 to 3 minutes and this is maintained for 15 minutes. Then the milk coming out of the top of the coil is allowed to pass through the cooling pipes. As the milk moves through these pipes, it radiates its amount of heat to the water. The water absorbs heat energy and its temperature rises. A part of the water evaporates causing cooling. Cooled milk is obtained from the top of the coil and is collected in well washed bottles. The bottles are sealed and stored in refrigerator.

Applications

1. The device is used for pasteurization of milk.
2. It can be used to heat water (when cooling unit is not operated).
3. The water used as coollant (due to high specific heat) gets heated and used for cleaning utensils in the kitchen.
4. The device can be used for preparing tea or coffee (when cooling unit if off).



16

Wooden T.V. Antenna

Student : Subrat Biswas
Teacher : Subal Chandra Bowmik

Srinagar High School
P.O. Srinagar, Sabroom
Tripura South

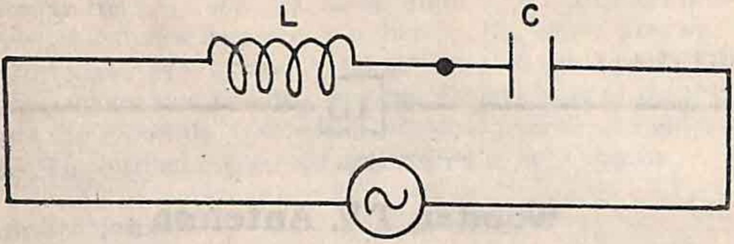
Introduction

The Wooden Antenna, with minimum cost, is made of two equal wooden frames by flexible wires, metallic nails and by a permanent magnet of a damaged Radio. While a metallic antenna may cost from about Rs. 200/- to Rs. 250/- or so, the wooden antenna costs about Rs.20/- only in village area and it is economical for the poor people. So,the wooden T.V. Antenna of New Technology is more favourable for all kinds of people. In long distant places this antenna transmits bright pictures also.

Scientific Principle

The structure of the antenna itself is a resonating circuit with respect to the incoming TV signal from local transmitter. The configuration of the loop can contribute two independent circuit-elements — (i) the inductance as it is required in all receiving antennas and (ii) a capacitance. The loop may be thought to be the series combination of inductance (L) and the capacitance (C) as is shown in the following diagram.

According to Faraday's law of Electromagnetic Induction, an induced voltage is developed due to variation of magnetic flux linked with the coil when the incoming TV signal from



local station interferes with the loop. The induced EMF can be written as:

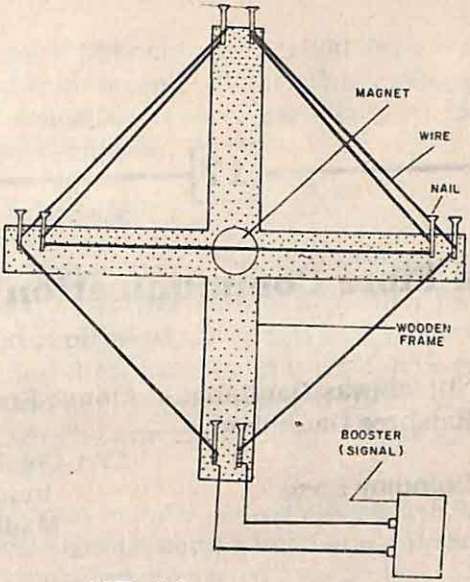
$$\varepsilon = 2\pi\upsilon BA$$

Where ν = frequency, B = magnetic flux density, A = effective area of the loop.

This induced voltage may be considered as the voltage applied across the series combination of L and C. Fortunately, the value of natural frequency $(1/2\pi\sqrt{LC})$ of electric oscillation in antenna circuit is expected to be around the middle of the band-width local TV transmission. As a result the circuit exhibits resonance in the bandwidth of local TV transmission due to flatness of resonance curve. The voltage fed to the booster is Q-times the induced voltage. The lower triangular part of the antenna contributes a variation of maximum response with the variation of $\pi/4$, where π is the wavelength. Resonance of oscillations of magnetic domains in the magnet can produce high amplitude in electrical oscillation of the induced EMF.

Materials Used

1. Two Wooden frames of size (45 cm × 7.5 cm)
2. Nine metallic nails of about 4 cm
3. A permanent strong magnet of a damaged 3 bands Radio
4. 3 m flexible wires.



Construction and Working

Two wooden frames of size (45 cm × 7.5 cm) are crossed perpendicularly at the middle point by a metallic nail. A permanent powerful magnet of damaged radio of the radio maker shop is adjusted at the middle point of the frames by dendrites. Two nails are adjusted side by side upon the 1st pole of the frame and next two nails are adjusted in one behind another in the 2nd pole. Next 3rd pole and 4th poles are followed like the first pole and 2nd pole respectively using two nails in each pole. A part of 1st portion of the flexible wires are opened from the coverings and these flexible wires are coiled with 1st nail of the 1st pole of the frame and the wires are encircled through the outer side of nails to make a triangular like circuit as shown in the Figure above. The last ends of the wires are also exposed from covering and these wires are recoiled with 2nd nail of the 1st pole of the frame. Two bare ends of the flexible wires are connected with feeder wire through the signal booster of the T.V.

In place of wood, either the plastic frames or bamboo frames or any other non-conducting frame may be used in this process to make the antenna. Any good conducting wire may be used to make the circuit.

17

Optical Fibre Communication System

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Introduction

One of the most interesting developments in recent years in the field of telecommunication is the use of optical fibres to carry information over large distances. It has been proved in the past decade that lightwave transmission through optical fibres is superior than that achieved through wires and microwave links. Typically, optical fibre has a much lower transmission loss per unit length (0.15-5db/km) and is not suspectible to electromagnetic interference. Economically also, it serves our purpose. The ever increasing cost and the lack of space available in the congested metropolitan cities asks for an advent of a less costly system. This demand is fulfilled by the optical fibre. A typical cable of optical fibre has a quite reasonable cost and weight only about 3kg/km.

The conventional telephonic systems use copper wires which easily get oxidised and as such require high maintenance cost. The optical fibres being made of glass are non-reactive and hence economical. Also, the noise pick up by the copper wire or in electrical signals is quite substantial whereas in optical fibres, the noise pick up is negligible.

The optical fibre communication system is both scientifically and economically viable. This model of the optical fibre communication system goes hand in hand with the theme of the exhibition.

Scientific Principle

The basic principle involved in the exhibit is that any form of energy can be converted into any other form of energy. So, any kind of physical signal can be converted into electrical signals and these signals, in turn, can be converted into any other kind of energy by using transducers (Transducer is a device which converts one kind of energy into another kind of energy.).

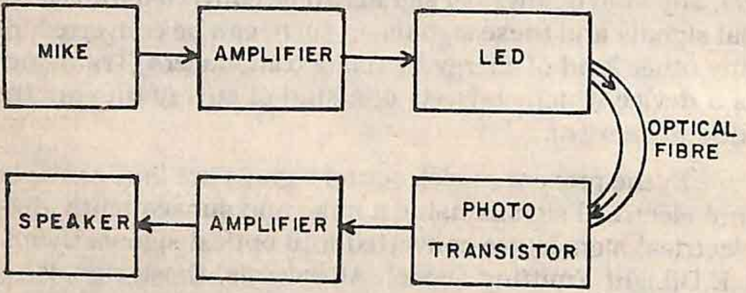
In the present model, sound signals are first converted into electrical signals using a mike and subsequently these electrical signals are converted into optical signals using a L.E.D(Light Emitting Diode). Afterwards, these signals are transferred using an optical fibre at the other end. These signals are converted into electrical signals using a photo transistor. Now these electrical signals are converted into sound signals using a speaker.

So the sound signals at the mike are regenerated at the receiver end in the speaker. In the above system, mike, L.E.D, photo-transistor and speaker are all transducers. Optical fibre works on the principle of total internal reflection of light.

Materials Used

1. Mike
2. Amplifier
3. Registers
4. PCBs
5. Capacitor (Polar and Ceramic)
6. IC (356 op Amp)
7. Transistors (NPN and PNP)

8. L.E.D (Light Emitting Diode)
9. Couplers
10. Optical Fibre
11. Photo transistor
12. Speaker
13. Power supply
14. Electric wires



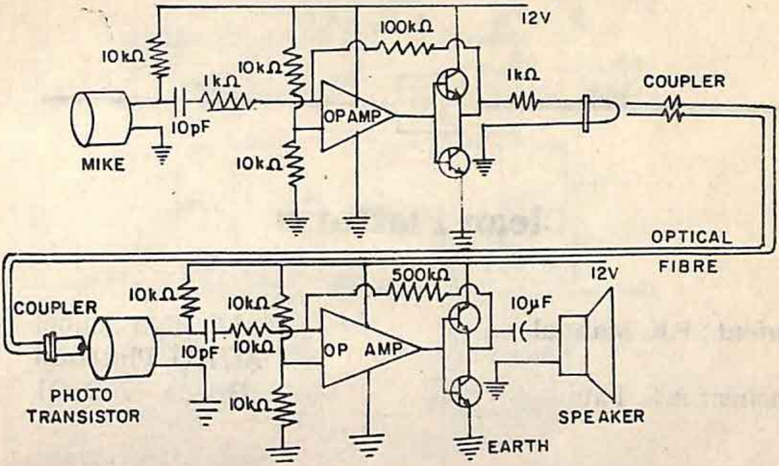
Construction and Working

A schematic block diagram is shown in Fig. 1.

Mike	*Amplifier*	*L.E.D*	*Optical Fibre*
Sound signals made at the mike	Signals from mike are amplified so that it can drive an LED	Electrical signals are converted into optical signals	It carries signals

Speaker	*Amplifier*	*Photo Transsistor*
Electrical signals which are amplified are reconverted into sound signals at the speaker	Energy of signals is amplified to drive the speaker	The electrical signals are regained from the optical signals

The model of the optical fibre communication system presented here is based on a number of components such as mike, amplifier, L.E.D, optical fibre and speaker (Fig. 2)



A Schematic Block Diagram

Applications

1. Optical fibres can replace the telephone wires in the communication system as it can carry as many as 672 signals at a time through a singal optical fibre and without cross talk. Its maintenance cost is also low. Also, the system is trouble free.
2. Optical Fibre Communication System is also used for transmission of data in computers or for long distance data transfer. We can transmit analog or digital signals also.

References

1. Handbook of Fiber Optics: Theory and Applications
2. Concepts of Physics by H.C. Verma.

18

Clean Platform

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Introduction

This is an exhibit demonstrating the principle of automatic cleaning of the Railway Platforms by the passing trains. The exhibit is a moving toy train with cleaner flaps attached to each compartment.

Scientific Principle

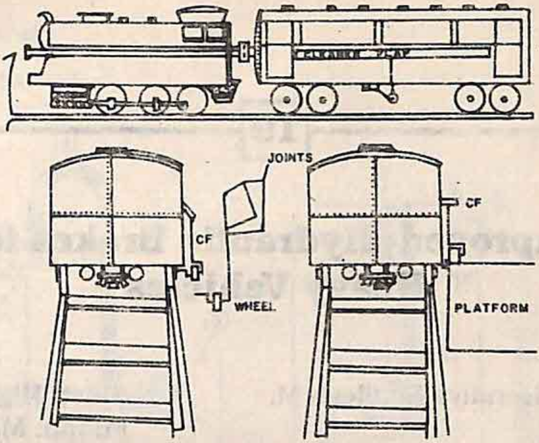
The principle of gravity and operation of hinge joints are involved in this exhibit.

Material Used

1. A toy train with tracks
2. One board for display
3. Two thin tin flaps
4. Two small wheels.

Construction and Working

To each compartment of the train is attached a cleaner flap on both sides. The flap is made out of thin tin metal and is fixed just below the window with the help of hinge joint. When the train reaches the platform, the small wheel at-



tached to the cleaner flap gets in contact with the platform which is slopped at both the ends. As soon as the cleaner flaps wheel touches the slope portion of the platform the cleaner flap get raised and sets in a upright position and remains as long as the train is at the platform. Now the real operation begins. Passengers throw banana peels, orange skins, food packets, tea cups and other wastes into the cleaner flap which is very close to their windows. When the train leaves the station the waste material is carried away by the cleaner flap and as soon as the slope of the platform ends, the small wheel gets disconnected and the flap comes down dumping all the waste into a dust bin, kept at the end of the platform leaving behind a neat, clean and environmentally healthy platform.

Another system is made to keep the rail track passing through the platform clean, while the train stands at the platform. Usually it is noticed that some passengers use the toilets in the train when it is standing at a station. This human waste falls on the track and pollutes the atmosphere of the station. When the train arrives at the station, the outlet of the toilet gets closed from below by clean flap and prevents toilet waste from failing on the track. As the train leaves from the station, the flap opens by going-down and all the waste automatically comes down, keeping the track clean.

19

Improved Hydraulic Brakes for Heavy Vehicles

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Introduction

In heavy vehicles Hydraulic brakes are mainly used to reduce speed and stop such vehicles. In the hydraulic brakes, brake oil and wheel cylinder are used. The oil reaches in the wheel cylinder and enables to brake off the speed. Sometimes, due to defect of the machine, air-bubble enter in the wheel cylinder along with the brake-oil and serves as an obstacle to the braking system As a result of this accidents take place. This defect can be removed by fixing extra nipples which can save major accidents in all possible ways.

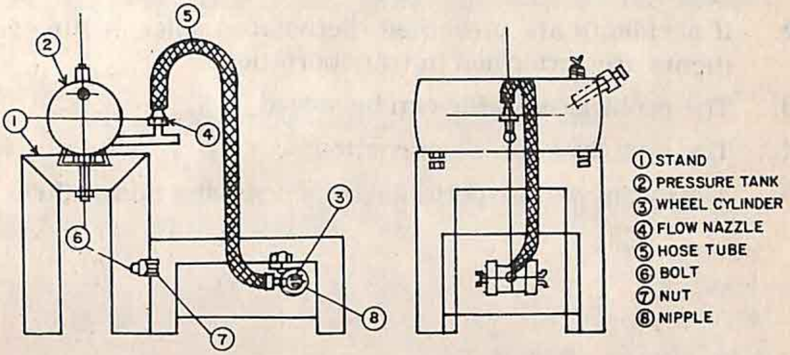
Scientific Principle

Hydraulic Principle

Materials Used

1. Primus pressure tank
2. Nozzle
3. Hose tube
4. Wheel cylinder
5. Nuts and bolts

6. Stand
7. Brake oil



Construction

As shown in the Figure, a primus pressure tank is kept on the stand. One end of hose tube is joined with the wheel cylinder. A small nipple is also fixed in the hose tube in the wheel cylinder.

Working

First of all, brake oil is filled in the primus pressure tank then it is pumped fully with air to get enough pressure. While letting on the pressure valve brake oil goes in the hose tube with pressure and enters into the wheel cylinder. It is seen that piston extends in motion. Now if this piston is joined with the vehicle's wheel then it will be seen that the piston stops the speed of the vehicle at once. Now if air bubble also enters along with the brake oil in the wheel cylinder, the piston does not extend in motion and as a result the brake fails.

One nipple can be placed in the wheel cylinder to prevent the defect of hydraulic brake. In this system, air-bubbles can be easily seen coming out of this nipple and once again the piston functions into motion and extends completely in the wheel cylinder. As a result brakes are applied at once and the vehicles brakes down its speed.

Advantages

1. In place of simple hydraulic brake, this type of new system can be used for preventing accidents.
2. If accidents are prevented, better and safer arrangements are performed in transportation.
3. The problem of traffic can be solved.
4. The fatal lives can be prevented.
5. The means of transportation becomes faster and swifter.

20

Subodh Dial Protractor

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Introduction

We need accurate measurements and these must be simple. For the measurements of small lengths, we have Dial Vernier Callipers. A number of instruments giving accurate reading on a "Dial" are available in the market.

1. Dial Vernier Callipers
2. Dial Thermometers
3. Dial Micrometers Screw Gauge
4. Dial Thickness Gauge
5. Dial Spring Balance.

It is a protractor **(Subodh Dial Protractor)** to measure an angle on a dial. To the best of our knowledge no company manufacturing precision instrument has produced such type of protractor. Not a single company has mentioned so in its catalogue. The protractor giving readings on a dial has been designed for the first time.

The Scientific Principle

The arms of divider rotate about its Pivot Point through an angle. A gear attached at the pivot point rotates through the same angle. Another gear having less teeth is coupled to the first gear so that the second gear performs more number of rotations. This gives magnification of the original angle.

$$\text{Magnification} = \frac{\text{No. of teeth of the first larger gear}}{\text{No. of teeth of the second smaller gear.}}$$

Material Used

1. Divider from a old instrument box of an engineer
2. Nut bolts (1/8" × 2")
3. Nut bolts (1/8" × 1/4")
4. Nut bolts (1/16" × 1/2")
5. Material sheet (1 mm thickness)
    - i. 6cm × 7cm × 1mm Part D
    - ii. 3.5cm × 10m × 1mm Part E
6. Aluminium Dial
    - i. Main Dial 6. cm (diameter)
    - ii. Secondary Dial-8cm (diameter)

DIAL PROTRACTOR

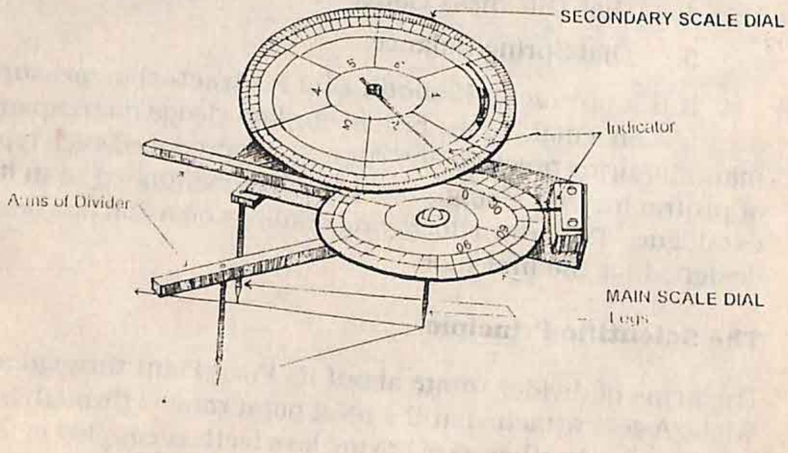


Fig. 1

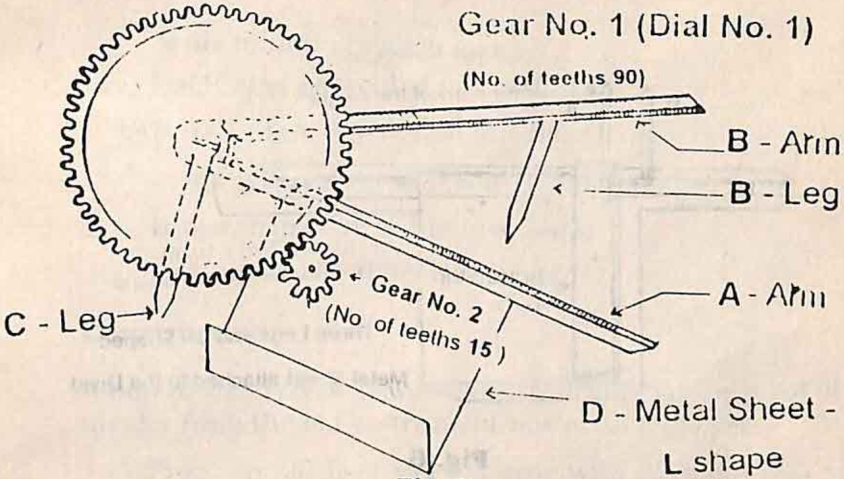


Fig. 2

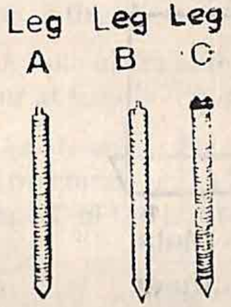


Fig. 3

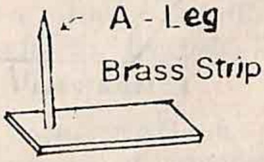


Fig. 4

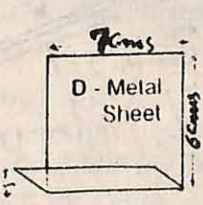
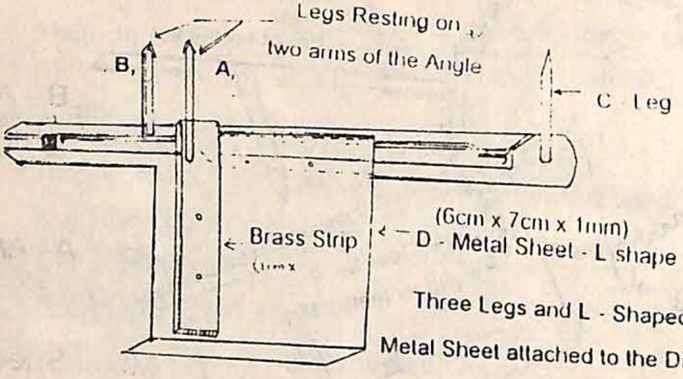


Fig. 5



Three Legs and L - Shaped Metal Sheet attached to the Divid

Fig. 6

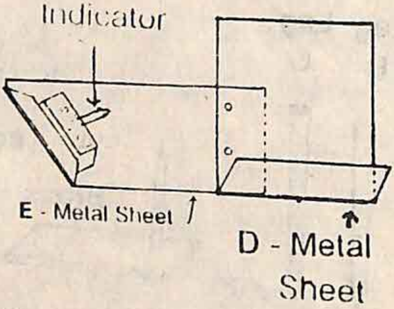


Fig. 7a

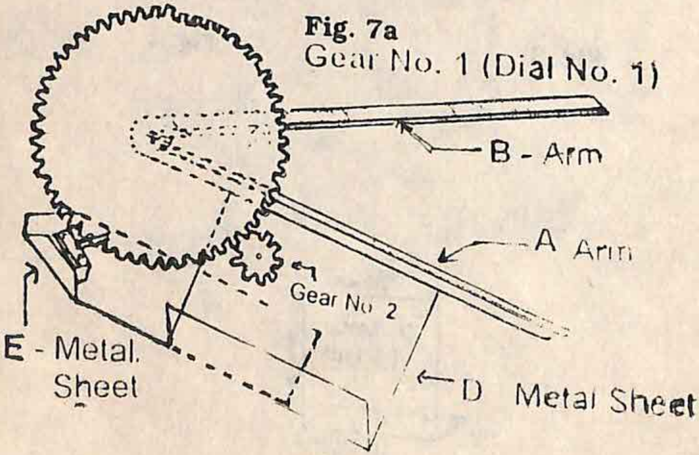


Fig. 7b

7. Arms from time piece
8. Calibrated paper dial for readings
    - (i) Main dial 6.1cm (diameter)
    - (ii) Secondary dial 8cm (diameter)
9. Brass strip (1cm × 4.5cm × 1mm)
10. Gears from old wall clock.

Construction

A bolt of size 1/8" × 2" was fixed by drilling at the pivot of a divider from the old instrument box of an engineer.

From an old wall clock a gear with 90 teeth was selected. An aluminium dial of diameter 6.1cm was fixed to the gear. These were fixed to the pivot point of the divider by means of the above bolt. (Fig. 2)

A hole of diameter 1 mm was drilled on an arm of the divider at length 7cm from the pivot point.

As shown in Fig. No.3 a turned bolt (with the help of lathe machine) 1/8" × 2" was fixed in this hole. This is called the leg **'B'** of the protractor. (Fig.3).

Leg **A** was fixed to the brass strip (1 cm × 4.5 cm and thickness 1 mm) by drilling a hole at a distance of 5 mm (Fig. 4).

The metal sheet of size 7 cm × 6 cm and thickness 1 mm was bent in L shape. This is called plate 'D'. The arm 'A' of the divider is fixed to this plate D by means of nutbolt (Fig. 2).

The second small gear having 15 teeth was fixed on plate **D** such that is should match the first gear fixed to pivot point (Fig. 2).

The brass strip with leg **A** is attached to the plate **D** from lower side such that the legs **A** and **B** and the leg on the pivot point **C** should be in the same straight line making an angle of 0° when the arms of the divider are closed.

Another metal sheet **E** attached to the plate **D** as shown in the figure and the indicator for the main dial is fixed to the plate **E** (Figs. **7a** and **7b**.)

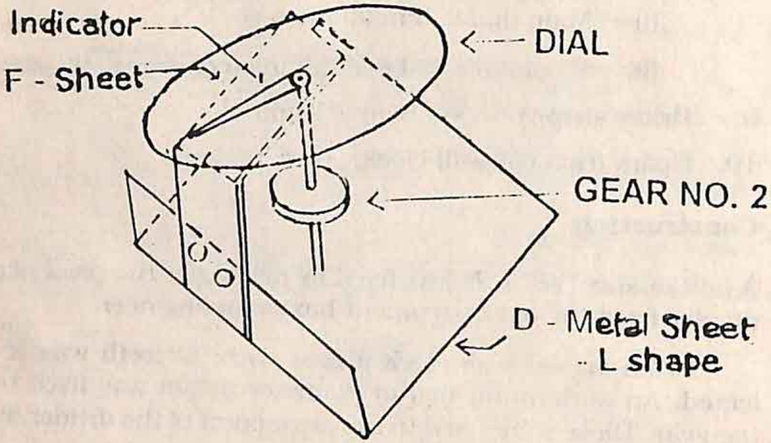
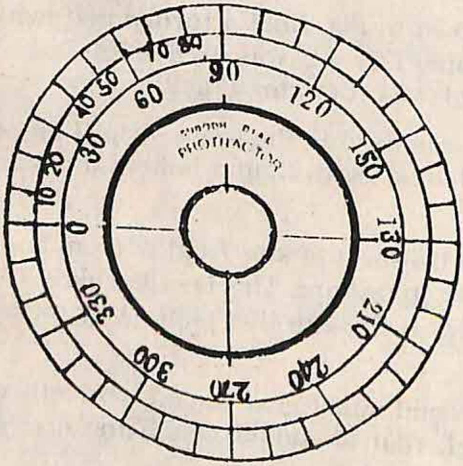
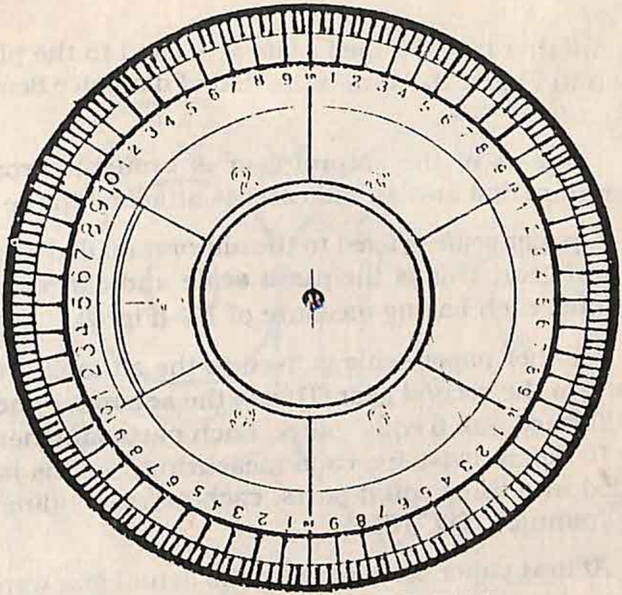


Fig. 8



MAIN SCALE DIAL

Fig. 9



SECONDARY SCALE DIAL

Fig. 10

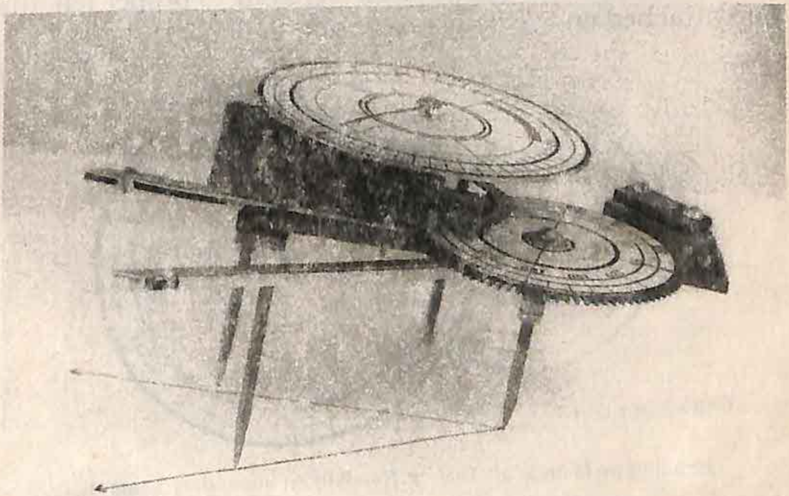


Fig. 11

Another ┌── Shaped plate **F** is fixed to the plate **D** as shown in Figure 8. Aluminium dial of diameter 8cm is fixed on it.

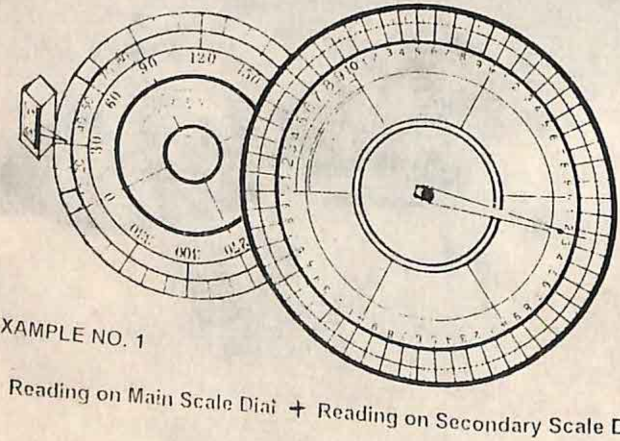
The axis of the second gear is brought through this aluminium dial and an indicator is attached to the axis.

A paper scale is fixed to the aluminium dial attached to the first gear. This is the **main scale** and carries 36 equal divisions, each having measure of 10° (Fig. 9).

Another paper scale is fixed to the aluminium dial attached to the second gear. This is the **secondary scale** and is calibrated into 6 equal parts. Each part is further divided into 10 equal divisions; each measuring 1°. This is further divided into three equal parts, each corresponding to 1/3° or 20 minutes (Fig. 10).

At first paper scale of twice the actual size were drawn using a bowpen and a letra set (Transferable latra set) and then 50% reduction Xerox copies were taken. This produced clean and accurate paper dials.

The arms from a wall clock were cut to proper lengths and attached on the dials nos.1 and 2. (Fig.11).

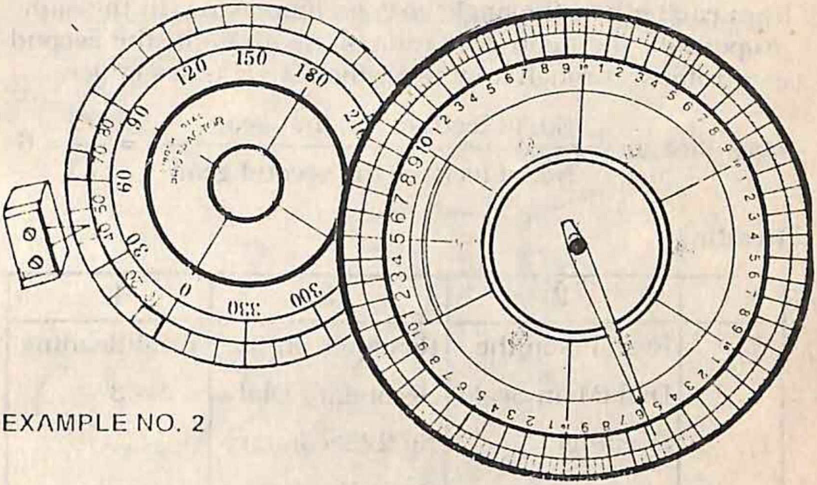


EXAMPLE NO. 1

Reading on Main Scale Dial + Reading on Secondary Scale Dial

$30^\circ + 2^\circ\,20' = 32^\circ\,20'$

Fig. 12



EXAMPLE NO. 2

Reading on Main Scale Dial + Reading on Secondary Scale Dial

40° + 5° 40' = 45° 40'

Fig. 13

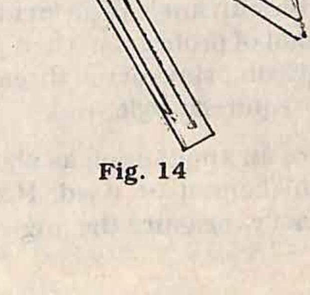


Fig. 14

Working

To measure the angle drawn on a paper, using Subodh Dial Protractor, the pivot leg **C** is kept on the vertex of the angle and the legs **A** and **B** are kept on the sides forming the angle.

As we open the divider and the legs **A** and **B** move away from each other, the angle goes on increasing. In the same proportion, the main gear rotates. As a result, the second gear rotates through an angle which is six times larger.

$$\text{Magnification} = \frac{\text{No. of teeth of the first gear}}{\text{No. of teeth of the second gear}} = \frac{90}{15} = 6$$

Reading

1	2	3	4
	Reading on the Dial (Main Scale Reading)	Readings on the Secondary Dial No.2 (Secondary Scale Reading)	Total Reading = 2 + 3
Ex. 1 Fig.12	30°	+2° 20'	32° 20'
Ex. 2 Fig. 13	40°	+5° 40'	45° 40'

Least Count

Subodh Dial Protractor measures 1/3 part of a degree accurately. Hence, the least count is 20'.

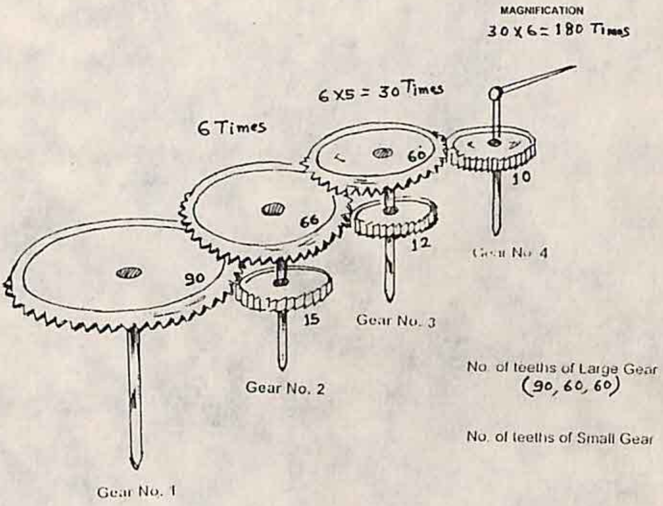
In order to draw an angle of given measure, first set the measure on the dial of protractor. Then press the protractor on the paper to give imprints of the three legs. Join the three point of give the required angle.

In the case of an angular job as shown the Fig. **14**, the normal protractor cannot be used. However Subodh Dial Protractor can easily measure the angle.

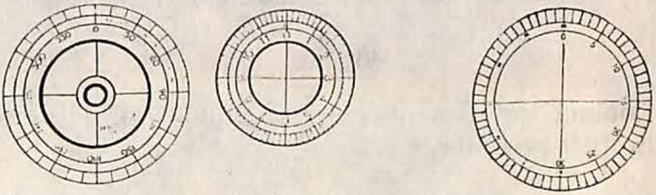
Applications

1. It has more porecision and accuracy because of the improved least count and can be used for precise work.

2. It can be used in the engineering works such as angular jobs where normal protractor cannot be used.
3. It can be used to draw accurate angles on a plain paper.



DIALS FIXED ON GEARS



Each Part of 10°
DIAL NO. 1
(Set on Gear No. 1)

Each Part of 1°
DIAL NO. 2
(Set on Gear No. 2)

Each Part is of 1/30 degrees
(= 2 min)
DIAL NO. 4
(Set on Gear No. 4

L.C. = $\frac{1}{30}^{\circ}$

= (2 min)

Fig. 15

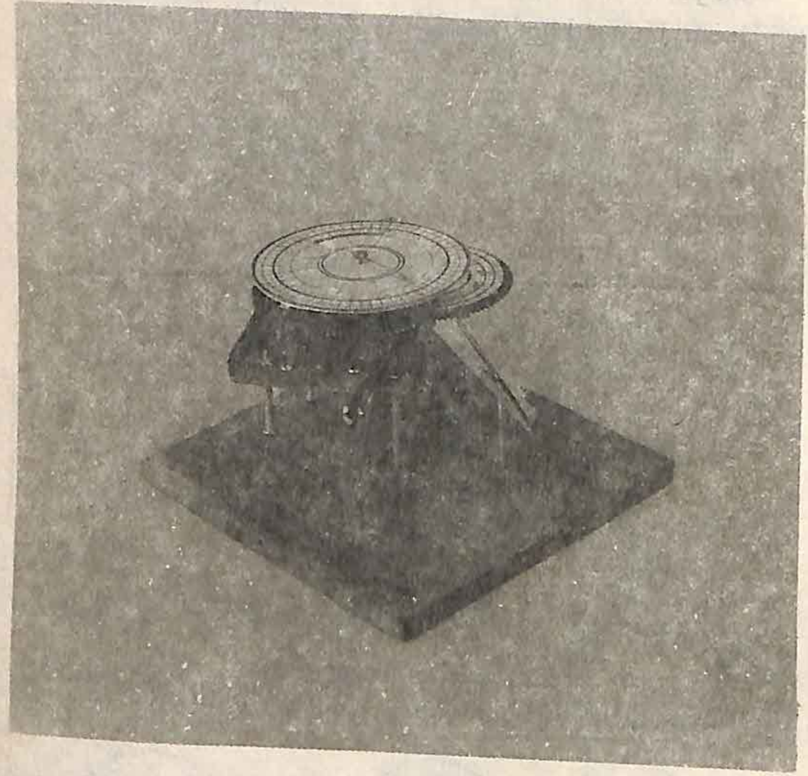


Fig. 16

4. Engineering students can use Subodh Dial Protractor in their every day work.

Special Features of the Instrument

1. Simple to use.
2. Reading on a dial.
3. Least count = $1/3° = 2'$.
4. Measurement of angular job more accurately and conveniently.

Further Improvements Suggested in the *Subodh Dial Protractor*

As shown in Fig. 15, four gears can be used to magnify 180 times the original angle.

Gear No.	No. of teeth of Smaller Gear	No. of teeth of Larger Gear	No. of Rotations	Magnification = Total no. of rotations
1	......	90	1	1
2	15	60	90/15 =6	1 × 6 = 6
3	12	60	60/12 =5	6 × 5 = 30
4	10	......	60/10 = 6	30 × 6 = 180

Thus, when first gear rotates through 360°

gear no. 4 will complete 180 rotations.

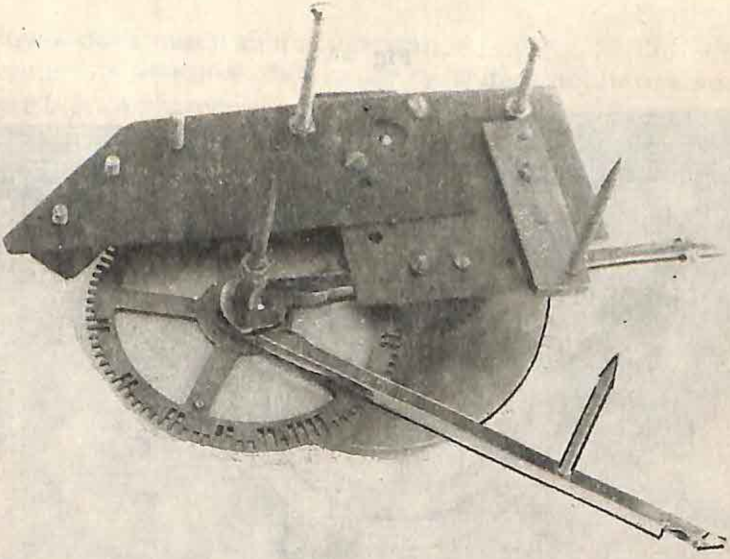


Fig. 17

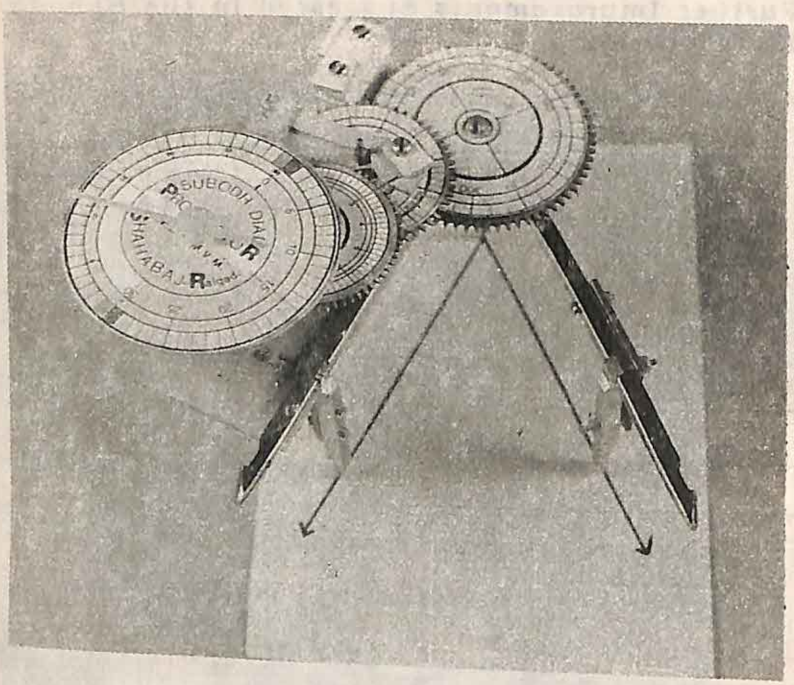


Fig. 18

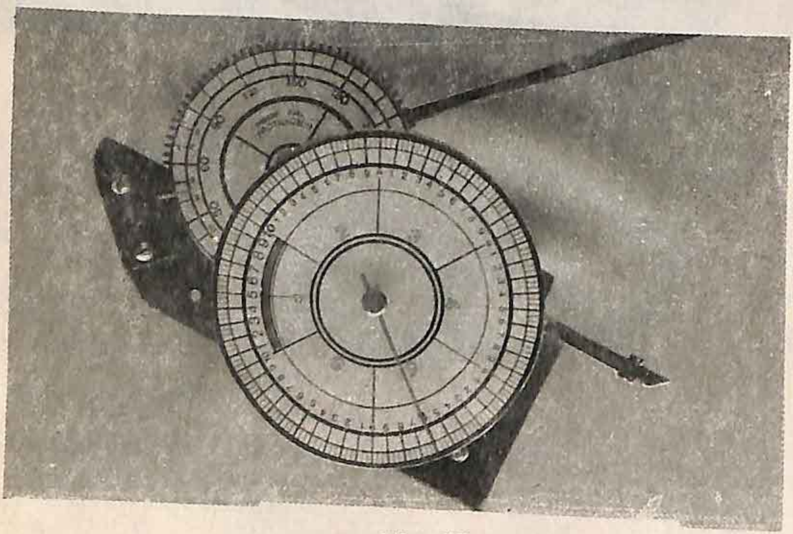


Fig. 19

21

Spark Plug as an Air Filling Device

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Khatankar Swaroop

Teachers : V. Kulkarni
V.V. Sare

S.K. Walawalkar
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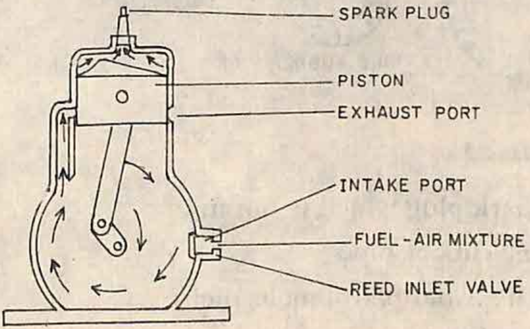
Maharashtra

Introduction

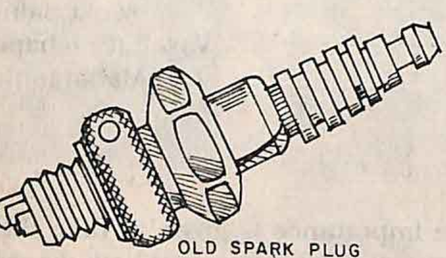
Now-a-days much more importance is given to time than money. As we know that motor cycle does not have a spare tyre (i.e. stepheny), In case of a puncture, especially in rural areas or barren road, the motor cycle owners face a lot of troubles. This device will give a great relief to them in case of puncture. They can inflate their tyre by this device and can run the motorcycle to a nearby vulcanizing centre without any trouble.



Scientific Principle

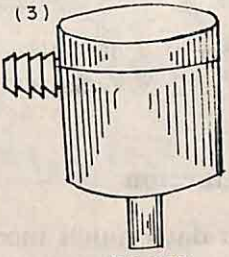
The instrument is mainly useful for petrol engine two wheelers (both two stroke and four stroke).

The basic principle behind the exhibit is to make use of highly compressed air available during the compression and exhaust stroke of a petrol engine to inflate the tubed tyre. The compression ratio for these engines is generally in the range of 7 to 9 and the compressed air during the compression and exhaust stroke developes a pressure of about 2.5 kg/cm^{2}to 30 cm^2. This compressed air is used to inflate the tyre by using this simple attachment.



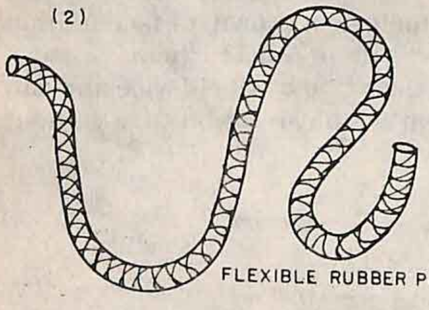
OLD SPARK PLUG

(3)



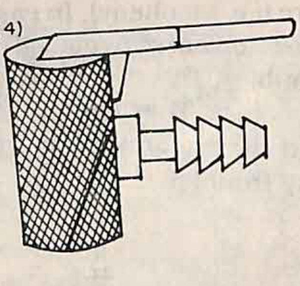
FILTER

(2)



FLEXIBLE RUBBER PIPE

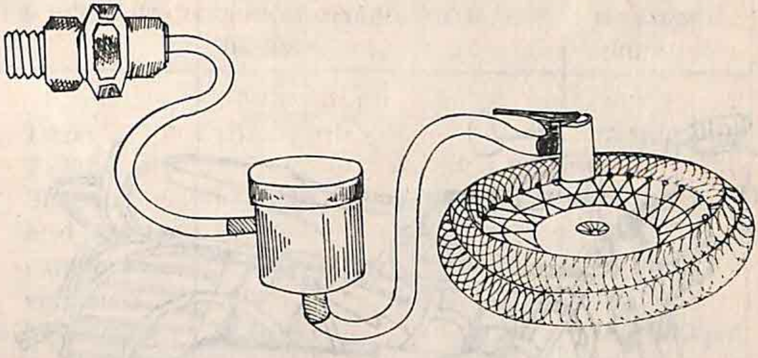
(4)

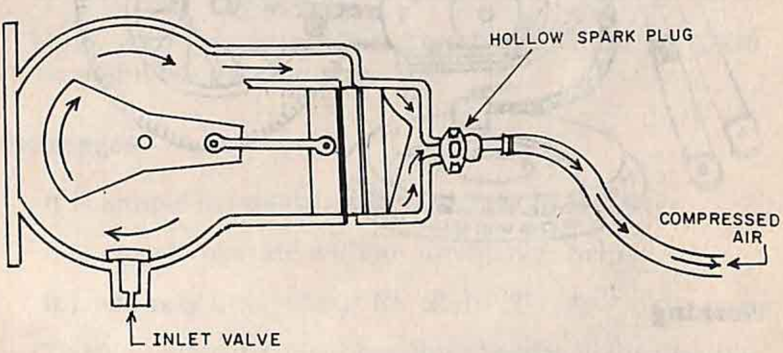


AIR FILLING TAP

Materials Used

1. Old spark plug which is not in use
2. Flexible rubber pipe
3. Filter (to avoid petrol molecule)
4. Air filling tap.

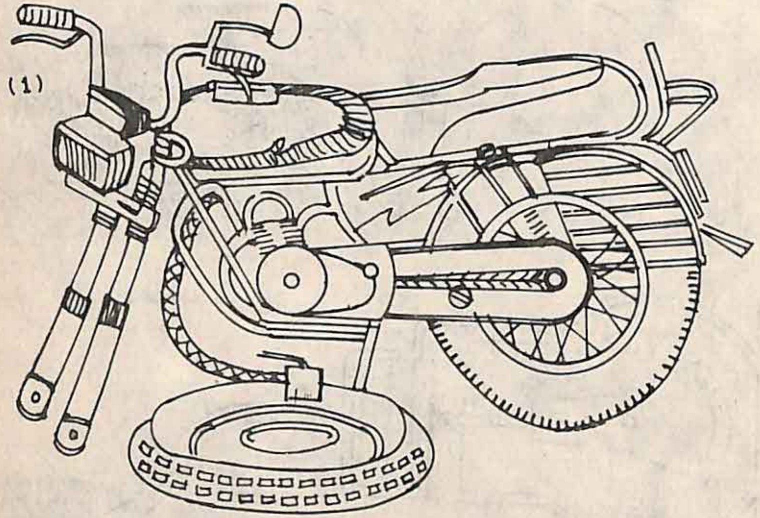




Construction

The highly useful device is constructed as follows:

1. Take an old spark plug of a two wheeler which is not in use.
2. Break the ceramic body and the central electrode of the spark plug and make its metallic socket free.
3. This socket (i.e. hollow spark plug) perfectly fits in the cylinder head of the engine.
4. Insert a rubber pipe in the socket and attach an air filling valve at the other end of the pipe with a filter inside the pipe.
5. Make all the joints leak-proof by means of some adhesive like M-Seal and the device is ready for use.



Working

1. Close the petrol cock of the vehicle.
2. Run the engine for some time till all the petrol left in the carburettor is burnt completely.
3. Remove the original spark plug from the engine.
4. Fit the hollow spark plug socket (i.e. our exhibit) in the cylinder head.
5. Tighten the air-filter tap with the valve of the tube.
6. Gradually kick up the vehicle. With every kick the highly compressed air available during the compression and exhaust stroke is filled in the pneumatic tube of the tyre which gets inflated.

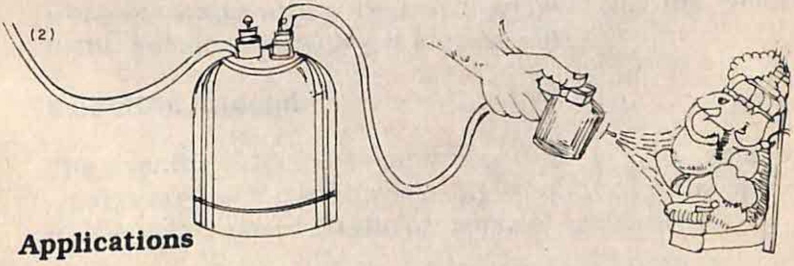
The following results were obtained from different two wheelers . The test is carried out by removing the air in the pneumatic tube completely.

Type of two wheelers	*Approximate number of kicks required to inflate the tube*	*Pressure developed*
1. Luna, TVS 50	15	28 to 30 psi
2. Scooter and Scooter category vehicles	17 to 18	28 to 30 psi
3. Motorcycle	18 to 20	28 to 30 psi

Thus, with very little effort suitable inflation pressure can be maintained in the tyre.

Advantages

1. It is simple in construction and easy to handle.
2. It is easy to operate without anybody's help.
3. It costs very little, about Rs. 25 to 30 only.
4. The filter fitted in the rubber pipe absorbs all the residual fumes and of petrol and does not effect the rubber tube.
5. No fuel of any kind is necessary.



(2)

Applications

1. This small instrument can be used to inflate the two wheeler tyre.
2. This attachment can be used for spray painting by adding an air tank in the system.

3. This attachment can be used to spray the fungicides or pesticides in the fields.
4. This attachment can be used for a petrol engine of four wheelers also.
5. The attachment can also be used for diesel engine vehicles.

References

1. Mechanical work and energy (Petrol engine), in Textbook of Science — 1 for Class X .
2. Working of Two Stroke and Four Stroke Cycle (Internal Combustion Engine) in the Textbook of Thermal Engineering, Power Engineering for IInd year Diploma Engineering.

22

Manufacture of Iodized Salt at Low Cost

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Introduction

Goiter is one the serious health problems India is facing today. The Government and mass media are trying to make people aware about the seriousness of the problem of deficiency of Iodine in food and drinking water. As per WHO's programme, most of the countries have made it compulsory to add Iodine to edible common salt.

The exhibit is about manufacturing iodized salt directly from sea-water at low cost without polluting the environment. People can easily get iodised salt.

Scientific Principle

The scientific principle behind the exhibit is to use solar and wind energy as the source of energy required for the production of salt is based on the principle of evaporation.

Materials Used

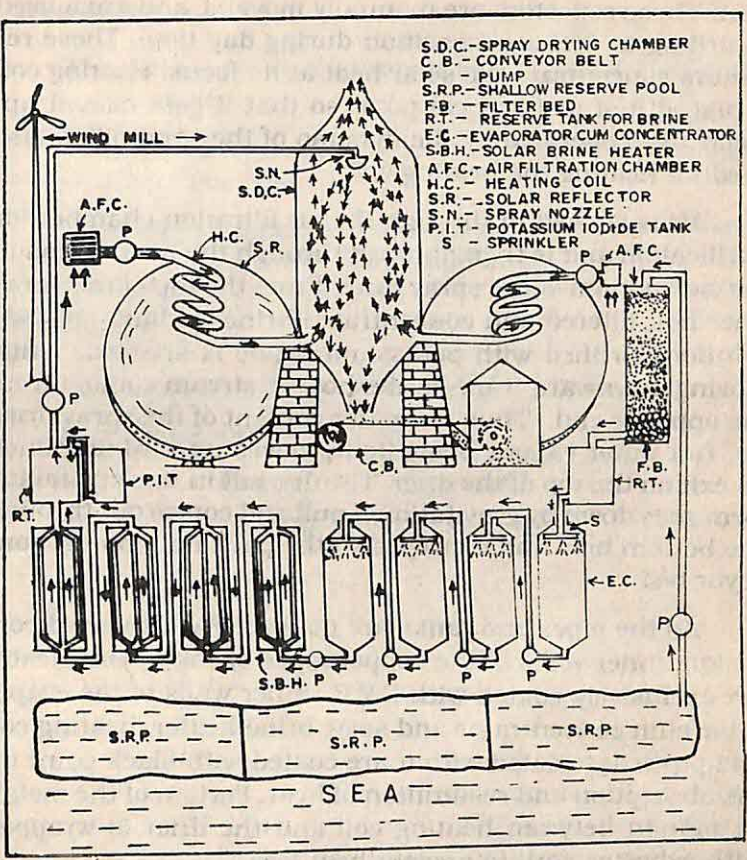
1. Shallow reserve pool (plastic tray as the pool)
2. PVC pipe (3" dia) as filter bed (containing gravel sand

both fine and coarse, activated charcoal — coconut shell charcoal.

3. Reserve tank for brine (plastic container)
4. P.V.C. and copper pipe
5. Array of evaporator cum concentrator
6. Solar brine heater
7. Air. filtration chamber
8. Heating coil (spiral copper tube)
9. Parabolic mirror as solar reflector
10. Reserve tank (Plastic container)
11. Spray nozzle
12. Pump
13. Pottassium iodide
14. Brine
15. P.V.C. cylindrical pipe as drier chamber
16. Dynamo
17. Iron rod for making of the tower
18. Sprinklers
19. Black colour
20. Heater coil
21. Gear and shaft
22. Conveyor belt
23. Board
24. Large funnel.

Construction and Working

During high tide sea-water floods/fills the shallow but wide pools (see diagram). At day time sun rays evaporate water to a large extent. This water is then pumped to the filter bed for filtration and stored in the storage tank. Activated charcoal makes the brine clear, odourless (if odour is present). Brine i.e. sea water is then allowed to pass through an array



of solar evaporator-cum-concentrator. Here the brine is sprinkled from the upper end of the evaporator and while it goes down it gets heated up by the sun rays. In this way it becomes hot and concentrated. Next the brine is allowed to pass through the large array of solar brine heater (modified solar water heater) to increase the temperature of the brine to about 60°C-70°C. It is then stored in a tank for a while. Required amount of potassium iodide is then allowed to mix with the brine. The brine is then pumped into and sprayed through spray nozzle from the top of the spray drier. Two large parabolic solar reflector are mounted well behind the drier. These reflectors are manually movable and are moved according to the sun's position during day time. These reflectors concentrate the solar heat at its focus. Heating coil is placed just at the focal point so that it gets heated up. Electricity generated by the dynamo of the windmill is also used for heating the heating coil.

Air is sucked in through the air filtration chamber for purification and is then pumped through the heating coil to the side bottom of the spray drier. From the top of the spray drier hot, filtered and concentrated brine (sodium chloride solution) fortified with potassium iodide is sprayed. While moving downward it meets the hot air stream coming from the opposite end. Thus the water content of the spray dries up. Hot water vapour being light, moves upward and finds its exit on the top of the drier. The dry salt in fine crystalline form goes down by gravitational pull and comes out through the bottom hole and conveyed to the packing room by conveyor belt.

All the pipes and tanks are made of P.V.C to avoid corrosion. Inner walls of the copper pipes of solar brine heater are exclusively coated with P.V.C. Inner walls of the evaporator cum concentrator and solar brine heater, heating coil and pipes associated with it are coated with black paint for the absorption and restoration of heat. Portion of the metallic pipe in between heating coil and the drier is wrapped with asbestos cord to prevent heat loss.

Conveyor belt and pumps are operated by the kinetic energy of the wind mill.

Applications

There is an ample opportunity to establish such a plant in small sector in coastal areas of our country. In tropical countries like India where sun rays fall vertically, they can be utilized for such purposes. The idea of manufacturing of iodized salt at low cost by using wind and solar energy will become a reality only when the technology will be properly utilized.

Advantages

1. The fuel source is eco-friendly as it does not pollute our environment.
2. The process utilizes simple technology with negligible maintenance cost.
3. It provides ample employment opportunities for semi and unskilled youths of coastal areas.

References

1. New Book of popular science, Vols. 1 to 6
2. Science Reporter
3. Jnan - O - Bijnan
4. Source Book for the physical sciences.

23

Automatic Water Level Indicator-Cum-Controller

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Teacher : Gurendra Chakravorty

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Introduction

It is generally noticed that the water flows from the overhead tanks. Many a times, it is found that motor pump is 'on' while the owner of the house goes out for the whole day. As a result, not only water over-flows from the tank, but there is also wastage of electricity and the electricity bill is higher. The present model can be used as a solution to all these problems.

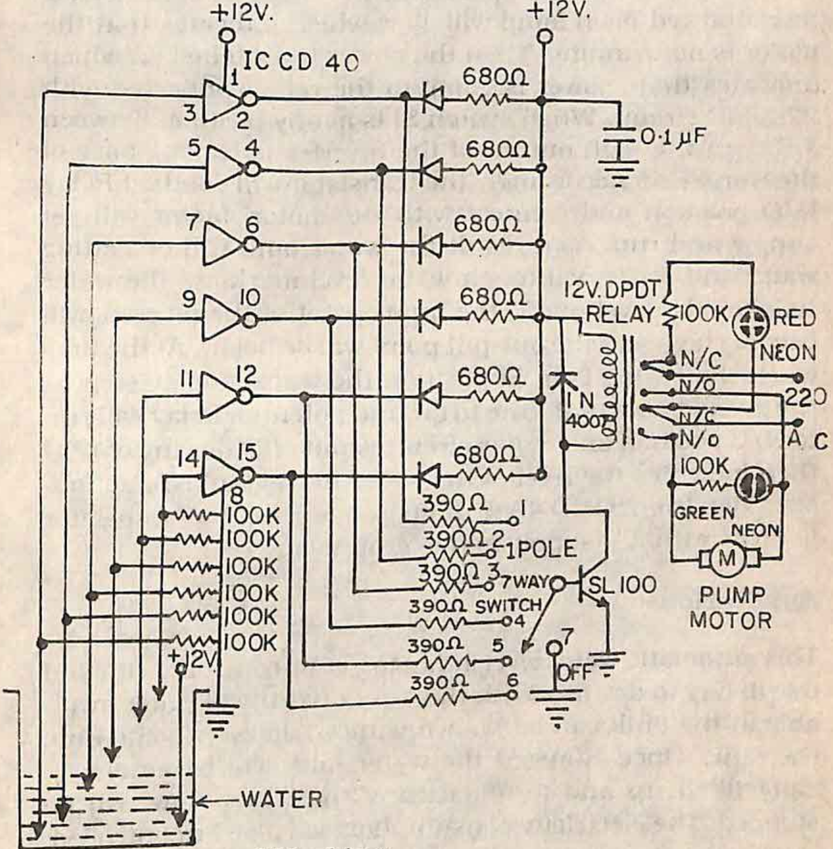
Scientific Principle

The principle involved in the model is the operation of the invertor IC. The principle of operation is when any input is high the corresponding out-put goes low and vice-versa. The low input to the input pieces is obtained by ensuring no supply to them and high input is obtained by flow of current from the common rod connected to the +ve supply through water to the superline sensor rod.

Materials Used

1.	Hex invertor IC CD 4049	1
2.	LED	6

3. 100 K Resistance 6
4. 390 W Resistance 6
5. SL 100 Transistor 1
6. IN 4007 Diode 1
7. Relay 250 W 12 V 1
8. Electric Pump Motor 1
9. Red and Green neon lamp 2
10. 0.1 mF Capacitor 1



Construction and Working

The invertor IC CD 4049 is used in this circuit. As shown in the circuit diagram sensored rod is connected to the input point. The height of the supply rod is equal to Sr. 1 or more. LED is connected to invertor output point, which indicate the water level of tank.

The transistor base is connected to 1 pole 7-way switch by which Relay function occurs. The quantity of the water to be filled up in the tank is determined or selected by this switch. When the tank is without water and the switch is at the invertor position then the whole input at input point is low and output will be high within 100K resistance. LED is not on and the ground potential will switch on transistor base and red neon lamp will glow which indicates that the motor is not running. Then the power is switched on which indicates that power is going to the relay connected with 220V AC circuit. When switch Sl is in any position between 1-6 then the high output of the inverter is leaving base of the transistor. Accordingly the transistor will conduct Relay N/O position and connect with the motor. Motor will get supply and run. As a result the water tank will be getting water and water will touch water level mark. As the water touches the level mark, the input point of the inverter will become high and the out-put point will be below. At the time when the switch is in Sl position the transistor base is at the ground potential. Due to ground potential Relay will run to N/C position and motor circuit is put off. Glowing of LED then indicates the level of the water in the tank. To get obstruction from IC CD 4049, high frequency 0.1 μF Capacitor is fitted with 2 V supply and is grounded.

Applications

This automatic water level indicator-cum-controller can find use in day to day life. With this unit quantity of water available in the tank can be known without actually going upto the tank. Once adjusted the water tank will be automatically filled up and automatically the water flow will be stopped. The electricity consumption will also be controlled.

24

Self Operative Device for the Handicapped

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Madan Lal

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Distt. Kangra
Himachal Pradesh

Teacher : Ashok Sharma

Introduction

At present life has gone very fast and the individuals have become so busy in their work that they are hardly in a position to spare sufficient time to provide proper attention and care to the handicapped or seriously ill members of the family. As a result, handicapped persons often feel very much ignored as they are wholly dependent upon others for their various requirements. The present exhibit has been designed to mitigate some of the hardships faced by a handicapped person so that he or she may become self sufficient to some extent.

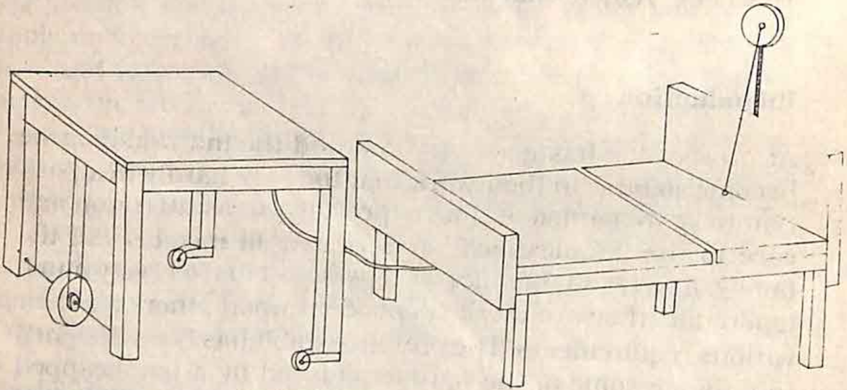
Scientific Principle

The basic principle behind this model is that in order to operate an electrically operated device or gadget, one of the basic requirements is that the electric circuit to which it is connected should be completed usually through a switch.

Based on this basic requirement the exhibit comprises devices with :

(i) A self operated, adjustable bed which can be raised or lowered whenever the handicapped person desires to do so. He/she has only to use a switch fixed on a switch board which is near his/her hand.

(ii) a movable tabe on which various needful articles like books, eatables and other articles may be kept. The table may be placed at some distance from the bed when the handicapped person does not wish to use the items on the table. However, whenever he/she needs some articles, he/she has simply to press another switch on the board and the table moves close to the bed. Once the requirement of the items on the table is over it can again be returned back to its original position with the help of the same switch.



Construction and Working

1. Self Operative Bed

This bed has two portions hinged at the middle. One half portion has been coupled with a D.C. motor. When the motor is switched on by the person lying on the bed, it rotates and one portion of the bed gets raised due to coiling of a belt or thread. Thus, the bed can be raised upto the desired height by switching off the current. Similarly it can be lowered by the same switch.

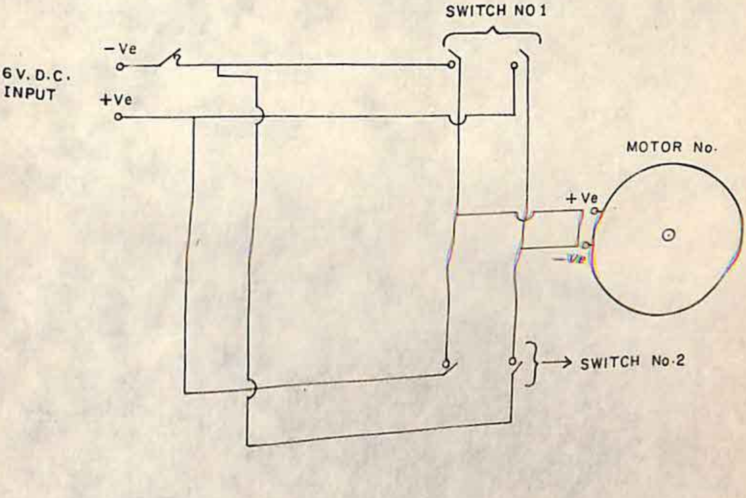
2. *Self Operative Table*

The table is also fitted with a D.C. motor which is coupled with a table having rollers fitted to its legs. The switch to control the movement of the table is kept near the hands of the person. It is a two-way switch which can provide both clockwise and anticlockwise rotations to the motor by changing the direction of the current. The motion of the motor facilitates forward and backward movements of the table.

Materials Used

1. Two D.C. 6V motors
2. One 6V stepdown transformer/battery eliminator
3. Two-way switches
4. A piece of plywood and other fabrication materials.

Circuit Diagram



Working

When the switch No. 1 is pressed towards left then it causes a clockwise rotation of the motor No. 1 fitted with bed. It lifts the half portion of the bed upwards and when the supply is cut off, the upward movement steps at that particular point. When the same switch is pressed towards right then the motor rotates in anticlockwise direction and un-winds the thread so that the portion lifted up gets lowered down.

Similarly when the switch No.2 is pressed towards left the motor rotates in clockwise direction which gives a forward movement to the table. When the switch is pressed towards right the motor moves in anticlockwise direction and results in the movement of the table in the opposite direction.

Applications

This arrangement can be used at home as well as in old age homes and Hospitals for those persons who need continuous attendance and attention. With this arrangement they may be made self dependent to some extent. Thus, it may help in providing a better care to a larger number of needy persons with limited manpower.

25

Fibre Optics

Students : Solanki Smit Kantilal
Bariya Mukund Amratlal
Teacher : Smt. R.U. Goswami

Govt. Middle Boys
School Diu

Introduction

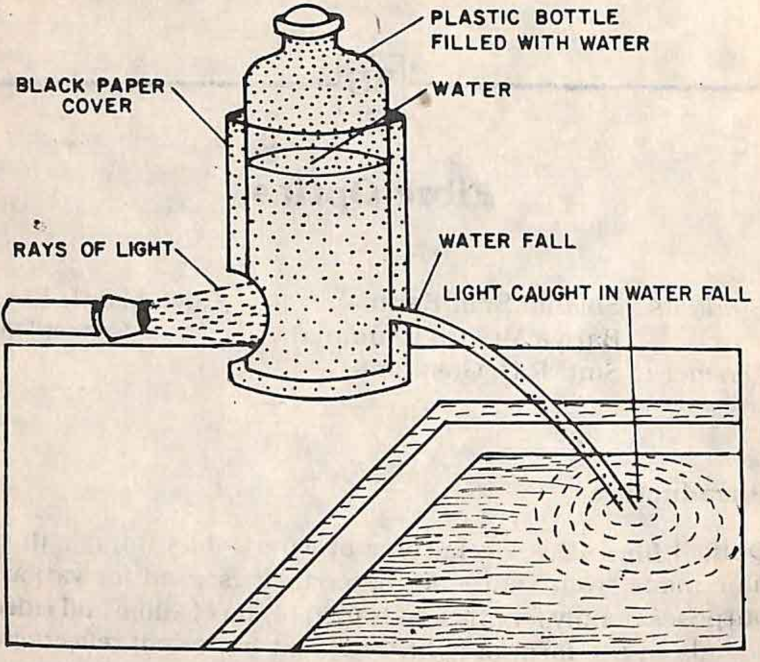
Optical fibre is a special type of wire (cable) thinner than hair made from synthetic material. It is used for various purposes mainly for efficient transmission of audio and video signals in the form of light. Frequent (repeated) reflections of LASER light result in transmission and reproduction of good quality sound, scene and viewing internal organs in the body easily.

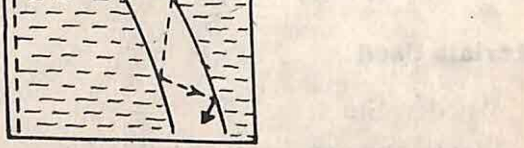
Scientific Principles

Repeated reflection of light in the optical fibre. The present model is *an analogy* for optical fibre.

Materials Used

1. Wooden Stool
2. Plastic (transparent) round bottle
3. Black paper
4. Torch in place of LASER
5. Tub
6. Thin Tube
7. Water





Construction and Working

Take a plastic bottle, make a small hole on one side of the bottle after leaving 2.5" space from the bottom. Take a black paper and prepare a cylindrical cover of the transparent bottle. Make a small hole of the same size in the black paper as made in the bottle. Further make a round circular hole of the diameter 2.5" on the opposite side of the small hole keeping the said small hole little in the centre. Now the exhibit is ready for working/experiment.

Do the experiment in a dark room. Keep the bottle on the stool as shown in the diagram. A tub, duly filled with little water, may be kept just far away from the stool. Now fill the water in the transparent bottle. Immediately switch on the torch light and rays should be passed through the round hole of diameter 2.5".

Unbelievable magic can be seen in front of sight. The water will fall in the tub from the small hole which will also appear to carry together the rays of the light. What a magic! The light will spread in the water of tub like a light caught in the water fall.

In this experiment the rays of light are not turned but they are reflected again and again (repeatedly) in the water-fall. The water-fall acts as a hollow tube in which the rays goes on bouncing continuously on the inner surface of the water-fall which automatically turned into a bow shape. The rays of light have not turned into bow shape but due to repeated reflections finally take a turn of bow shape. In short, inner surface of water-fall has worked as a mirror.

Applications

Fibre optic wires instead of metal wire (cable) and the light of Laser are used. The sound of Telephone can be sent to far away places like the waves of light. The scene in the television can be sent to distinct places like the waves of light. Communication can be done faster. A flexible fibre optic tube is introduced into the body allowing doctors to view internal organs directly.

References

Experiments of Professor Farget published in the Science magazine *SAFARI* for Children, October/November, 1996.

26

Cellular, Pager, DTH and Mobile Communication

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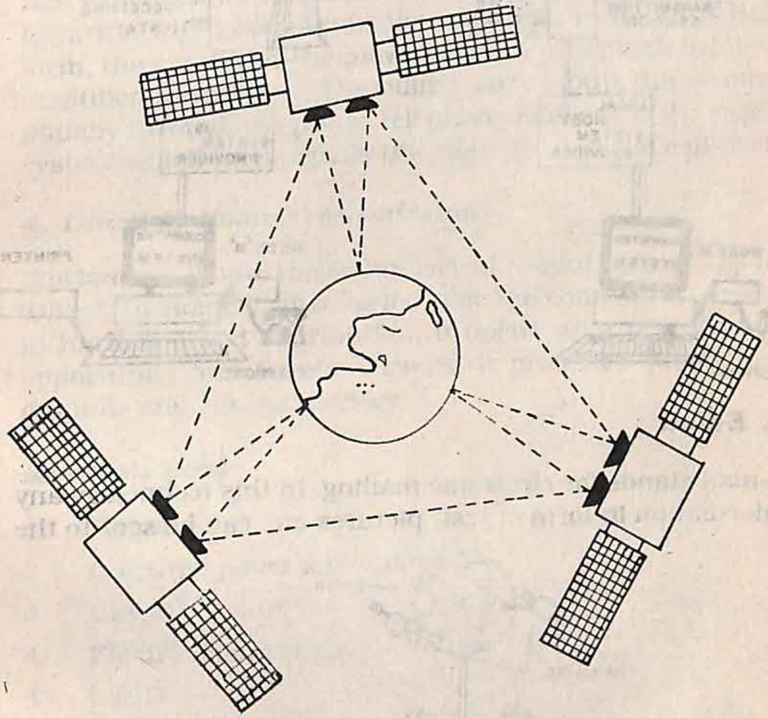
Introduction

Telecommunication have redefined the concept of boundaries. We could be closer to the people on the other side of the world than you are to the person in the next room. Walls have fallen, boundaries are disappearing and borders have cracked. Perhaps we will all go back to our roots, rediscover the joy of living in eco-friendly communities which will lead to reduced pollution, conservation of energy and increase in productivity.

All these imaginations will come true by the new telecommunication technology like cellular, fibre optics, pagers, etc. India too has taken its first step towards entering the new world of telecommunications. From ancient days when men used pegions for the fast transmission of mail to the mobile communication through phones, world has enhanced a great knowledge about itself. But the basic of all this advancement is to provide fast access to the data or information. This can be achieved through some of the current and advanced methods of fast growing communication systems like pager, cellular communication, electronic mailing, along with all the new way of television broadcasting - the DHT.

SATELLITE COMMUNICATION

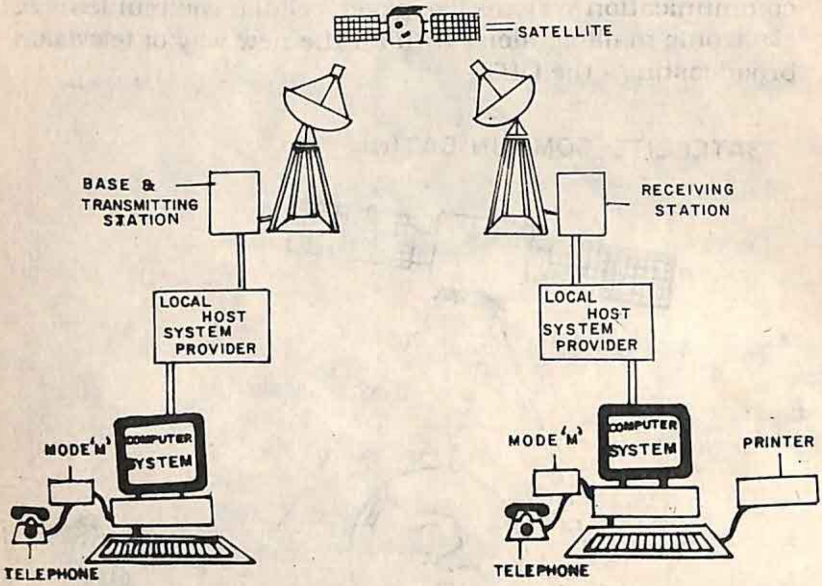


Description

1. Cellular Telecom

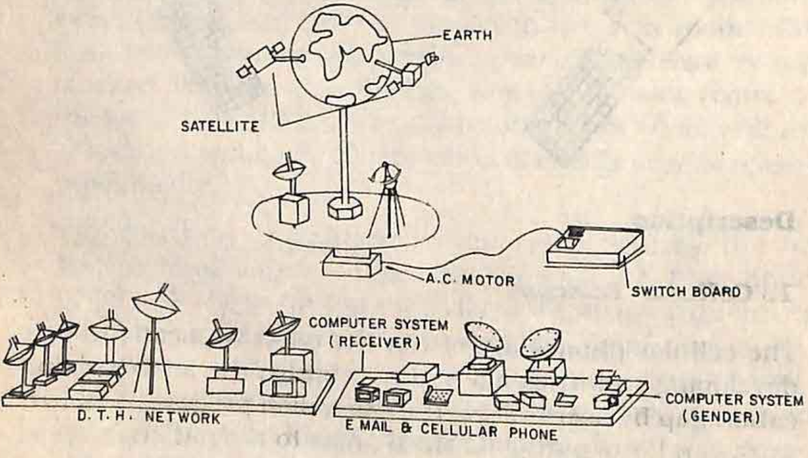
The cellular phones are one of the effective means to help developing countries like India to bridge the telecommunication gap by accelerating the expansion process in its networks and integrating its rural areas to the national, social and economic development process. It is a satellite based communication system.

E-MAIL NETWORK



2. E-Mail

E-mail stands for electronic mailing. In this technology any information in form of text, pictures etc. can be sent to the



desired destination by using computer-networks. The process of E-mailing is rather complicated but once got, there is no further problem.

3. *Radio-Paging*

A radio paging system is a one-way wireless messaging system which allows continuous accessibility to someone away from the wired communication network. In its most basic form, the person on-the-move carries a pager with the given identification number. The calling party inputs this number, usually through the public telephone network to the paging system which then signals the pager to alert the call-party.

4. *Direct to Home Transmission*

The latest step into the technological revolution is DTH—the 'Direct To Home' transmission. For the companies, dealing in hardware and distribution, it opens up a new world of opportunity and for the viewers, it promises quality programme and efficient service.

Materials Used

1. Plyboard
2. Coloured paper and charts
3. Globe
4. Electric-connection
5. L.E.D
6. Aluminium pipes and sheets
7. Thermocol.

Construction and Working

The exhibit mainly consists of four parts.

Part I

In the centre of the board, a globe is placed which represent our earth and is surrounded by three satellites keeping the whole coverage for the global transmission of the messages.

On the same board paging network system is picturised which includes a base and transmitting station, a receiving station and a pager model itself. It is a rotatory portion of the model.

Part II

It shows a basic E-mail network. The model includes the sender's computer-network and the receiver's computer network along with the transmitting and receiving station.

Part III

It depicts the method of D.T.H (Direct-To-Home) transmission. A model of the company providing D.T.H connection and the receiver antenna is picturised by constructing their small static models.

In this model a number of dish antennae are put up for the company's system which provides a number of satellite channels to a signal dish.

Part IV

It has two working models of cellular phones. If we speak in one of them we can hear the voice on the another. It has a maximum range of hundred metres.

References

1. Electronics for you - Science Magazine
2. Computer - Today - Weekly-Journal
3. Junior Science Refresher - Science Magazine
4. Information Technology - Magazine
5. Computer Science for Class XII

27

Remote Sensing

Students : L. Arun
M. Madhan Kumar
R. Wales King

Teacher : R. Murali

Dharmamurthi Rao
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Tamil Nadu

Introduction

Remote sensing can be defined as obtaining information about an object by observing it from a distance and without coming into actual contact. Surveying a country using surface transport system is extremely difficult, whereas, aerial view of survey is easily accessible. Land management use Satellite imagery to tell which remote range land are suitable for cultivation, forestation etc. For inventorying natural resources detecting pollutions, monitoring range lands and wild life habitat even spying on "Wildcatters" stripping woods from forest, unlicensed areas and water catchment areas.

Scientific Principle

Altitude viewing ensures bigger area in viewfield. Time period of Satellite, Aerial view, Infrared study, Light dependent resistance (LDR) theory etc. from the fundamentals of the knowledge needed for this setup.

Materials Used

1. Hard Board

2. Reflectors of Automobiles
3. Flash light
4. Improvised Satellite
5. Wiper Motor
6. Charged battery
7. LDRs
8. Glass plates
9. Improvised monitor
10. Improvised C.R.O to display signal
11. Satellite photo slide
12. Old photo flash
13. Cycle rims
14. Automobile cut edge belt and other electrical accessories.

Description

Observing our earth's surface from space through satellite or from air using aircraft modifies suitably.

Space Platform

or satellite system comprise of: a) Space Segment b) Sensor system c) Ground segments. India is in one of the small list of countries which has all these segments available and operational.

Space Segment

The space segment consists of the satellite which could be put into orbit and in which a sensor system is mounted, which in turn is the instrument which observes in preplanned formats and transmits them into the earth receiving stations. Factually, the process of observing and transmitting to the earth receiving stations is more or less a continuous process. The Satellite (IRS 1 A or 1B) is launched to an altitude of about 904 km. and orbits the earth in a North-South direction. Sensors are instruments, which sense the objects on the surface of the earth and records them.

Remote sensing technology uses the visible, infrared and microwave regions of the solar radiation to collect information about the various objects on the earth's surface. The Electro-magnetic spectrum has a visible region which we use to view an object with our eye. The Sun's energy when it falls on the earth gets partially absorbed and partially reflected. It is the part that is reflected that we generally use in remote sensing.

Limitations

1. General limitation in most cases is that when there is clouds cover, no data is obtained as the energy system in the visible ranges from Sun's energy cannot penetrate the clouds.
2. Ground resolution is generally inadequate for detailed studies at micro-level.
3. In most-cases positional accuracy is not adequate for regular mapping activities with precision and geographical accuracy.

Aerial Sensing

Due to the above limitations, Institute of Remote Sensing takes photographs of required regions from on board aircraft using special cameras (Aerial photo). For example urban development authority wants to take photograph of the developing area and developed areas for various projects should approach NASA. This agency will make necessary arrangements to take photographs of that region at different altitudes using special aircraft. The altitude of the flight ranges from 2000 km to 4000 km depending upon various departmental needs namely Geology, Water resources, Telecommunication, Agriculture, Electricity distribution and Rural development.

The photograph that has been taken by the aircraft is fed to the computer. This computer converts actual 3D pictures from the aerial photograph. From this photograph the corresponding department can take decision as how to achieve their goals for the benefit of the people in future. Apart from that they can take decision how to tackle the problem due to the existing situation.

Application

1. Satellite photographs of land portion give details about Vegetation area, Dry area, Rocky area etc. Photographs taken of the same area under different seasons (Summer and Winter) are compared in order to know how wastelands could be converted into croplands. Salt area can be identified and analysed using the satellite photo.
2. Aerial photographs of water in dams and water catchment areas during rainy season may be taken using special air craft. Based on this data, decision may be taken to raise the water level in dams in order to increase the Agriculture productivity and Hydro-electric power. Forest department can get various details like deforestation, soil erosion etc. Surface transport department can lay 'puckka' national highway and state highway roads. Since all those regions may be affected to rain and flood are known from IRs photo. So, they may take permanent remedy measures like construction of bridges or direction of existing route.

28

Clean-Up Water Kit

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Teachers : Ms. N. Kamala
Ms. A. Poonkuzhali

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Trichy - 14
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Introduction

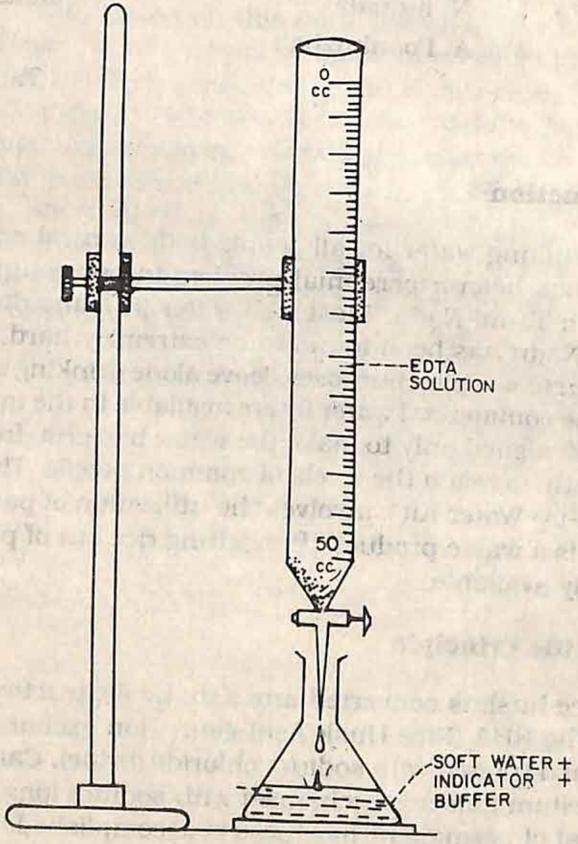
Safe drinking water for all people both in rural and urban areas has been a perennial problem in our country especially in Tamil Nadu. Most well water in many districts in Tamil Nadu has been found to be extremely hard, catering not even to washing purposes, leave alone drinking and cooking. The commercial water filters available in the market are either designed only to make the water bacteria free or are too costly to reach the levels of common people. The exhibit "Clean-up Water Kit", involves the utilization of paddy husk which is a waste product after getting rice out of paddy and is easily available.

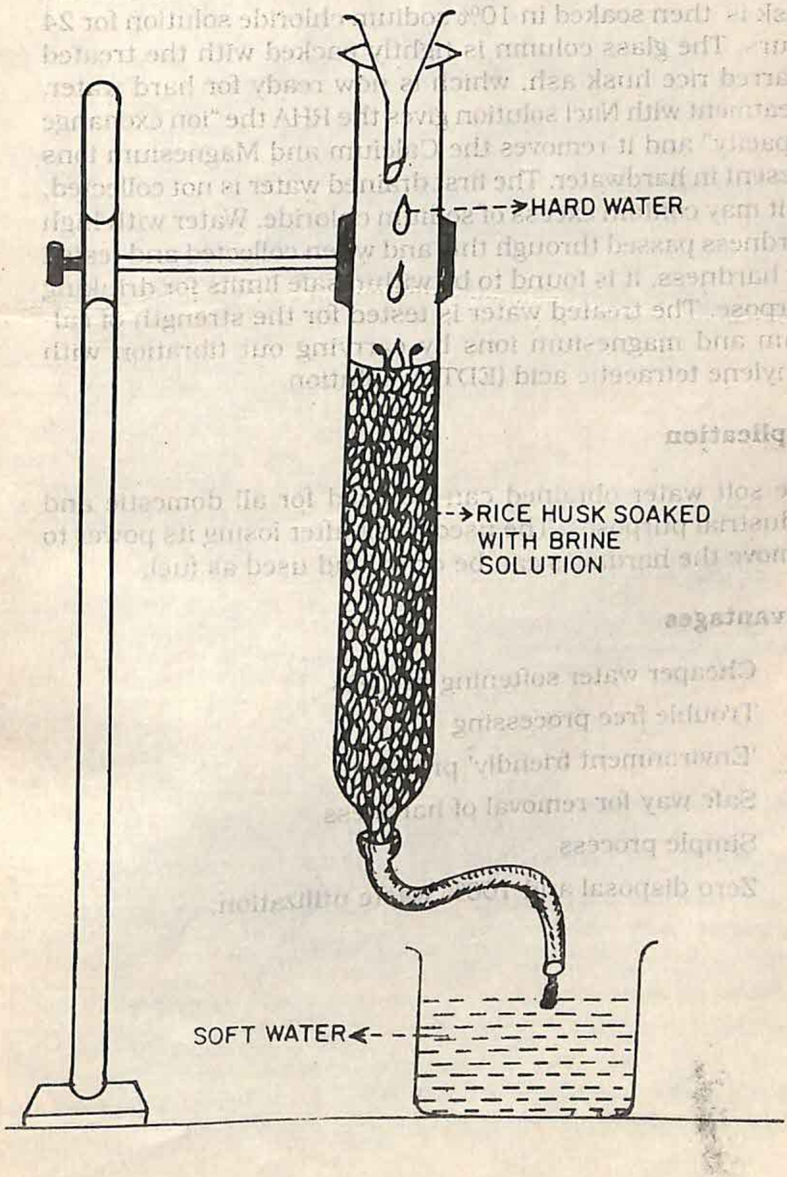
Scientific Principle

The rice husk is converted into ash, by destructive distillation. The RHA (Rice Husk Ash) gains "ion exchange capacity" when treated with sodium chloride (brine). Calcium and Magnesium ions are exchanged with sodium ions and thus removal of permanent hardness is accomplished.

Materials Used

1. Glass columns of 20 cm diameter and 100 cm length provided with stopper and narrow nozzle. (Metallic pipes can also be used for commercial purposes)
2. A vessel for collection of pure water
3. Rice Husk Ash
4. 10% sodium chloride solution
5. Distilled water.




HARD WATER
RICE HUSK SOAKED WITH BRINE SOLUTION
SOFT WATER

Construction and Working

Rice husk is converted into ash by destructive distillation. The ash obtained is actually porous and charred. It is soaked in distilled water and impurities are removed. The washed husk is then soaked in 10% sodium chloride solution for 24 hours. The glass column is tightly packed with the treated charred rice husk ash, which is now ready for hard water. Treatment with Nacl solution gives the RHA the "ion exchange capacity" and it removes the Calcium and Magnesium ions present in hardwater. The first drained water is not collected, as it may contain excess of sodium chloride. Water with high hardness passed through this and when collected and tested for hardness, it is found to be within safe limits for drinking purpose. The treated water is tested for the strength of calcium and magnesium ions by carrying out tibration with Ethylene tetracetic acid (EDTA) solution.

Application

The soft water obtained can be used for all domestic and industrial purposes. The used husk after losing its power to remove the hardness can be dried and used as fuel.

Advantages

1. Cheaper water softening process
2. Trouble free processing
3. 'Environment friendly' process
4. Safe way for removal of hardness
5. Simple process
6. Zero disposal and 100% waste utilization.

29

Over-head Projector

Students : Rondeep Kr. Nath Sivam
Suranjan Sharma Bharadwaj
Rajnish Saihia
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Don Bosco High School
Mangaldai-784125
Distt. Darrang, Assam

Teacher : Smt.Ayesha Bilkish

Introduction

Overhead projectors are used as teaching aids in many schools. Because the price of an overhead projector is quite high, majority of the schools cannot afford it. Efforts are being made to construct an overhead projector using inexpensive materials, and the present model is a step towards it.

Scientific Principle

A convex lens can produce a real and magnified image of an illuminated object on a screen when the object is placed between a distance or more than f (focal length) and less than 2f. However, to project a large image on a screen requires high degree of illumination of the object. This requires a strong source of light with a focussing arrangement. Moreover, in case of overhead projection, the object to be projected is kept horizontally whereas the image is thrown or focussed on a vertical screen. To achieve this, we use a plane mirror inclined at 45°. Now, a convex lens is placed before the mirror and is adjusted vertically to get a clear magnification of the object to be projected. The conjencting lens used to concentrate light on the object has been made by using water which is held on a transparent polythene sheet exactly above the source of light.

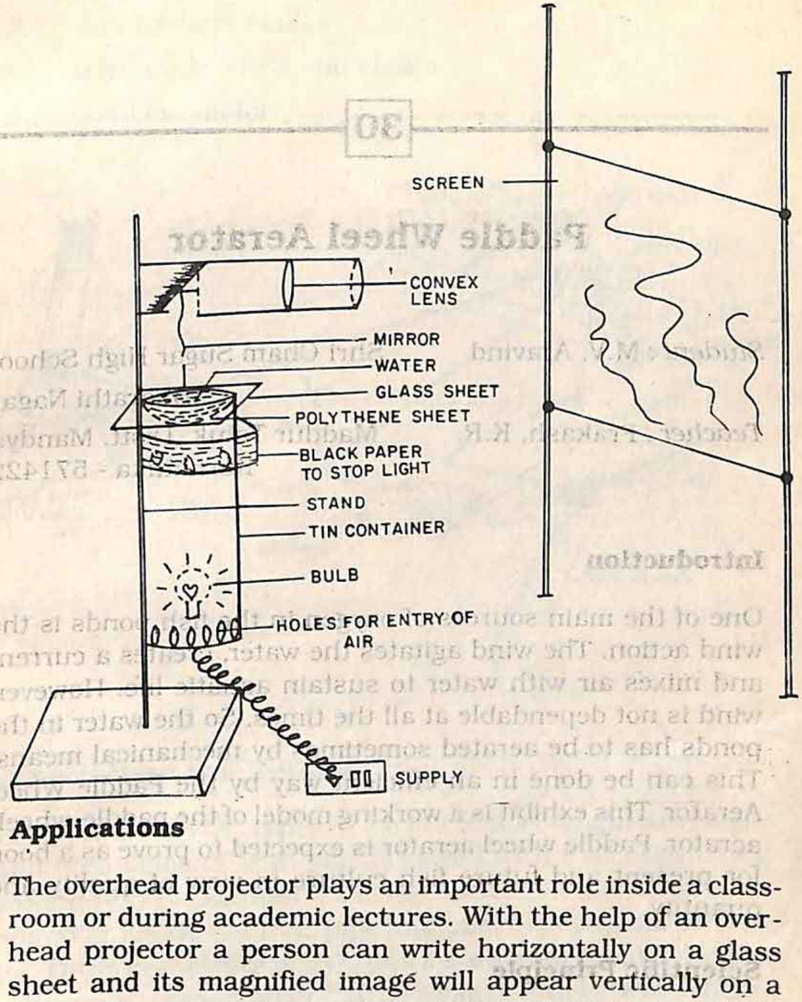
Materials Used

1. High Power bulb
2. Tin container
3. Plane mirror
4. Glass sheet
5. Convex lens
6. Transparent polythene
7. Insulated wire
8. Bulb-holder and plug
9. Water
10. Stand for supporting the projector
11. Supply.

Construction and Working

The construction of this model of overhead projector is not very complicated. It has been made simple enough to understand the principles.

Firstly, a high source of light is placed inside a container. Then a transparent polythene is fixed in the upper portion of the container and water is kept on the loose polythene. Secondly, a plane mirror is adjusted at 45° above the container. A convex lens is also placed before the mirror. The convex lens produces a real magnified image of an illuminated object on a screen when the object is placed between f (focal length) and 2f. Thirdly, a glass sheet is placed above the container. Finally, if we adjust the mirror and lens we can get a clear vision of the object placed on the glass. The basic working of this system lies in the position of the source of light and the convex lens. If anything is written on the glass sheet the projector will project it on to a vertical screen where the magnification will be large.



Applications

The overhead projector plays an important role inside a classroom or during academic lectures. With the help of an overhead projector a person can write horizontally on a glass sheet and its magnified image will appear vertically on a screen. A person can show diagrams, photographs (black and white), statistical bar diagrams, etc. when he or she is giving a lecture. Teachers can show different solutions of the problems. Compared to the blackboard, it is very useful. It gives clears magnification of the written words or the objects shown.

30

Paddle Wheel Aerator

Student : M.V. Aravind
Teacher : Prakash, K.R.

Shri Cham Sugar High School
Bharathi Nagar
Maddur Taluk, Distt. Mandya
Karnataka - 571422

Introduction

One of the main sources of oxygen in the fish ponds is the wind action. The wind agitates the water, creates a current and mixes air with water to sustain aquatic life. However, wind is not dependable at all the times. So the water in the ponds has to be aerated sometimes by mechanical means. This can be done in an efficient way by the Paddle Wheel Aerator. This exhibit is a working model of the paddle-wheel-aerator. Paddle wheel aerator is expected to prove as a boon for present and future fish culture in view of quality and quantity.

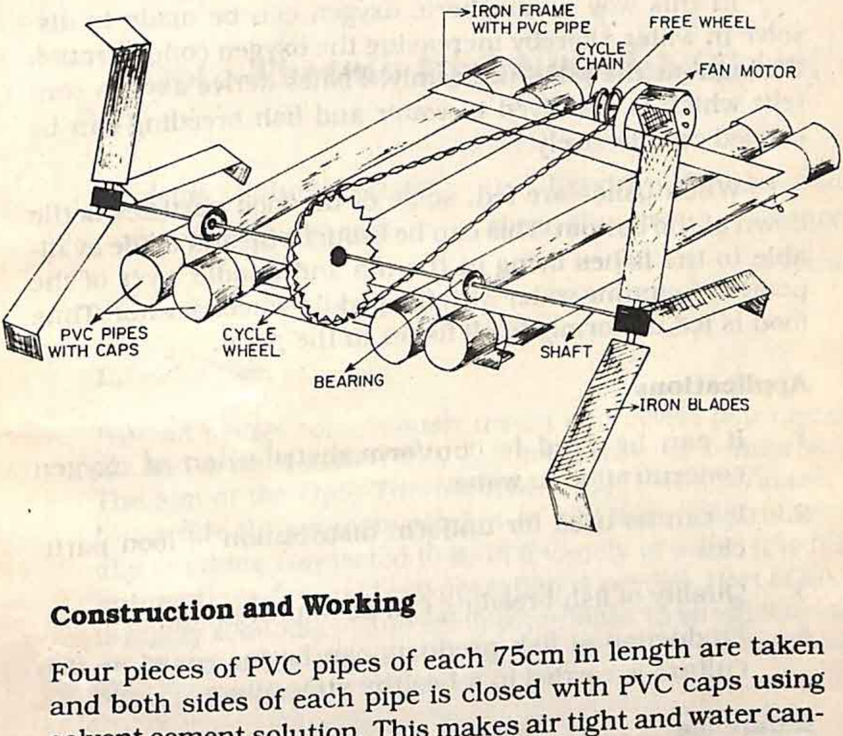
Scientific Principle

Paddle-Wheel-Aerator works on the principle that when water is splashed into the air, the water droplets trap air containing oxygen and fall back into the pond, thereby increasing oxygen concentration uniformly throughout the pond.

Materials Used

1. P.V.C. pipes, Caps, and Gum (Solvent Cement)
2. Used steel shaft

3. Iron bar and blades
4. Used cycle wheel and chain
5. Used fan motor



Construction and Working

Four pieces of PVC pipes of each 75cm in length are taken and both sides of each pipe is closed with PVC caps using solvent cement solution. This makes air tight and water cannot enter inside the PVC pipe and hence it can float on water. These four pieces of PVC pipes are arranged horizontally and parallel to each other having a gap of 2cm between them. Using iron bars and some small size nut and bolts and these 4 PVC pipes, a frame is prepared in such a way that the entire frame floats on water. On this frame, a fan motor fitted with pulley is mounted at one end. At the other end, a steel shaft having a cycle wheel at the centre is fixed on the frame using bearings. At the ends of the shaft two iron blades are fixed. A cycle chain is used for the pulley fitted to the motor and to the cycle wheel fixed to the shaft. Motor is covered using any plastic cover or moulding.

Paddle-wheel-aerator is made to float on water. When electrical energy is supplied to the motor, the blades start rotating. When the blades rotate, the water splashes into the air and the water droplets trap air containing oxygen and fall back into the pond.

In this way atmospheric oxygen can be made to dissolve in water, thereby increasing the oxygen concentration throughout the pond uniformly. Fishes derive oxygen content which is dissolved in water and fish breeding can be carried on effectively.

When fishes are fed, some of the food particles settle down at the bottom. This can be brought up and made available to the fishes living in the top and middle layer of the pond by agitating water with the paddle-wheel-aerator. Thus food is fed uniformly to all fishes in the pond.

Applications

1. It can be used for uniform distribution of oxygen concentration in water.
2. It can be used for uniform distribution of food particles.
3. Quality of fish breeding can be improved.
4. Production of fish products can be increased as fish culture is carried in a healthy atmosphere.

Reference

Project studies by K S C S T (Karnataka State Council for Science and Technology)..

31

Opto-Thermo-Hydro Switch/Alarm

Students : Rahul Srivastava
Rijo Joseph

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Kerala

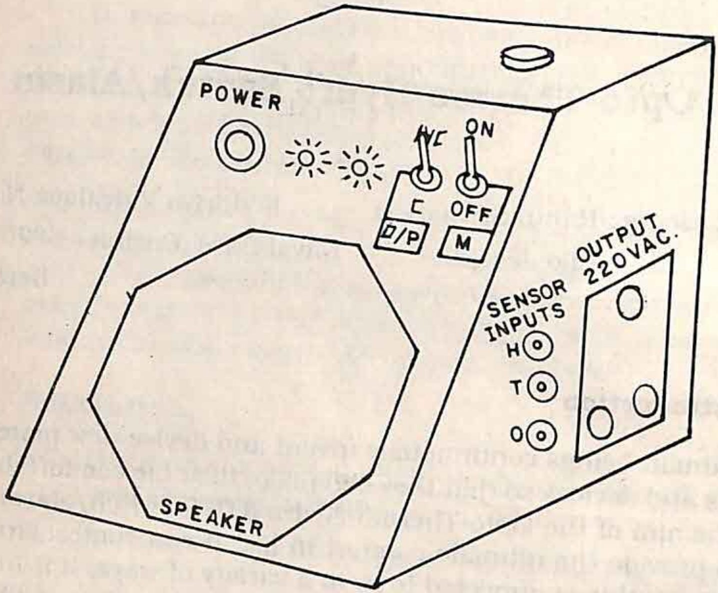
Introduction

Human beings continuously invent and devise new materials and devices so that they can make their life comfortable. The aim of the Opto-Thermo-Hydro (OTH) switch/alarm is to provide the ultimate comfort in life. It can control virtually anything connected to it, in a variety of ways. It is fully automatic and no manual operation is needed. Best of all, it is highly economical and easily affordable. In short, it brings quality to one's life and make it a much better and safer place to live.

Scientific Principle

We use energy in a number of forms such as light, heat, kinetic and potential energy of water. The energy levels of these sources available in our surroundings, keep on changing with time. The aim of the 'OTH' switch/alarm is to sense these changes in energy levels and to switch on or switch off any desired electrical gadget and sound an alarm, which is purely optional. For example, as an optical sensor for light energy source, it can switch on the street lights automatically when darkness falls at dusk and switch them off at dawn automatically. In the same way, it can also sense *ther-*

mal and *hydro* energy sources. There are numerous other applications of this device which are equally useful and important for us.



Description

There are basically 5 electronic circuits in this device all of which are equally important although the power source is derived from the supply mains (220V), the current consumption is very low. The optical and thermal sensors are highly sensitive. This unit can respond to 3 very basic and important sources of energy—the Optical, Thermal and Hydro energy.

In spite of it being possible to respond to only these three sources of energy it can be very easily adapted to respond to other sources of energy like sound energy. A clap switch makes potential use of sound energy. This can also be used at unmanned railway crossings where barrier can close automatically at the sound of train and open when the train has gone.

The unit has 12 modes of operation. All the 12 modes of operation of the device cater to a variety of human and seemingly cumbersome needs and have highly potential uses in our day-to-day life. The 12 modes and some of the uses have been given below. (OFF - means it will put off the appliance and ON—means it will put on the appliance at the desired trigger level of the energy source.)

Modes of Operation

MODES	USES
A. Optical Mode	
(1) Dark operated/ON	(a) Automatic porch lights and street lights
	(b) Beam cut burglar alarm
(2) Dark operated/OFF	(a) Automatic black out during war time
(3) Light operated/ON	(a) Keyhole burglar alarm
(4) Light operated/OFF	(a) Automatic doors
B. Thermal Mode	
(1) Under temperature operated/ON	(a) Automatic Room Heater
(2) Under temperature operated/OFF	(a) Automatic Defrosting System
(3) Over temperature operated/ON	(a) Automatic Room Cooler
(4) Over temperature operated/OFF	(a) Motor over heating preventer
C. Hydro Mode	
(1) Presence of Water/ON	(a) Flood level indicator
	(b) Rain alarm
	(c) Automatic clothes line

(2) Presence of Water/OFF	(a) Automatic overhead tank pump operator
(3) Absence of Water/OFF	(a) Electric pressure cooker bursting preventer
(4) Absence of Water/ON	(a) Automatic pump operator (b) Automatic continuous water supply provider

Setting up and Operation

There are four steps involved.

(i) Set the mode selector switches to the required mode.

(ii) Set the 'output' switch to 'continuous' 'or' 'non-continuous' mode as desired.

(iii) Set the output gadget switch to 'ON' or 'OFF' as desired.

(iv) Place the respective sensor as needed and connect the sensor at the desired place on the 'OTH'.

Now, the *OTH* takes control. After this no manual setting or switching is required and the device functions as desired automatically.

References

1. Book on 150 circuits.
2. Electronics for you - Part III, IV.

32

Negative Ion Generator

Students : Aastha Bajaj St. Mary's Convent School,
Neha Gambhir Assandh Road
Teacher : Asha Saxena Panipat (Haryana)

Introduction

Suitable environment is essential for better health and hence for better productivity. The workers in an unfavourable environment commit errors, in their work and do not give optimum output. One of the reasons for this unhealthy condition is the depletion of negative ions in the air. The depletion of negative ions is common in modern buildings with cemented surfaces and closed windows. The presence of T.V.sets, air conditioners, electric equipment etc. promote positively charged atmosphere. Lesser number of trees and exhausts of automobiles are some of the other reasons for the low level of negative ions in city atmosphere. If this depletion of negative loss is not counteracted then it will result in reduction of productivity, due to tiredness, lack of enthusiasm and lack of concentration of workers. Negative ion generator (Ionizer) is designed to increase the concentration of negative ions which is both physically and mentally healthy.

Scientific Principle

Negative ion generator produces large quantities of negatively charged or ionised air molecules. These negative ions attract excessive positive ions in the air and neutralise them and thus increase the concentration of negative ions.

Materials Used

1. Semiconductors;

   D_1 - D_{26} : IN 4007 1 A

   1000 V rectifier diode

2. Resistors:

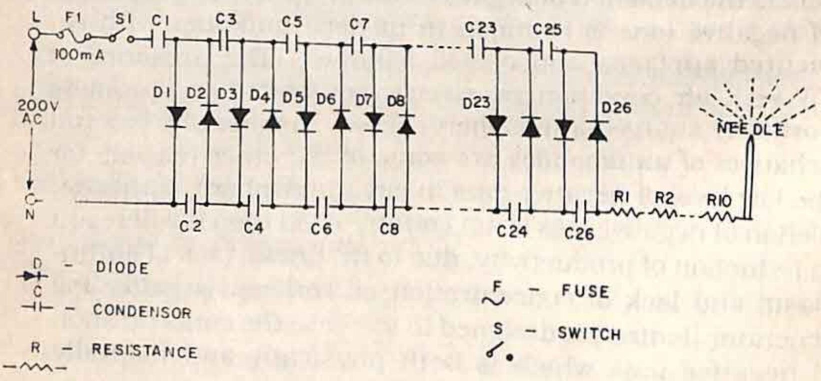
   R_1 - R_{10}: 3.9 megaohm, ½ W ± 5

3. Capacitors :

   C_1 - C_{26}: 22 μF/0.02 mF

   1000 V Ceramic disc

4. S_1 - ON/OFF Switch
5. F_1 - 100 μA panel mounting type fuse
6. PCB's
7. Sewing needles
8. Main leads
9. Hardware materials.



Construction and Working

A very high negative voltage is generated and applied to sharp needle points as the electric field strength will be maximum around the sharp pointed end of the needle. Air coming into contact with the point of a needle will become charged or ionised and the ionised air will then be repelled away by the electric field. Thus the negative ions are repelled by the negative charge of the needle, giving way for new air molecules to be ionised. Hence a constant flow of negative ions away from the needle is obtained. In this set-up, voltage used is 2.5 kv, voltage is boosted with a voltage multiplier circuit consisting of diode and capacitors. In order to step up the voltage from 240V to 3.5 kV, a voltage multiplier consisting of 26 stage multiplier is used. The mains input passes through fuse F1 and Switch Sl to the multiplier circuit — comprising of the capacitors C1 to C26 and diodes D1-D26. To withstand high reverse voltage diode IN 4007 is used. The output from the final stage of the multiplier is fed via a chain of ten 3.9 megaohm resistors to a needle. These resistors limit the current flow and hence ensure safety for the user in the event of the needle being touched.

Applications

The ionisor helps in revitalising the air and enhances the purification process. It thus freshens the air in a natural way. It is also useful in factories, air-conditioned rooms, homes, hotels, offices and cars, etc.

References

1. S.C. Gupta, S.K. Gupta, Mahavir Singh, Smt. Kulwant Kaur, New Fundamental Physics Vol. II, for A.I. C.B.S.E
2. K. Sundra Rajan, Electronics for You (EFY)

The Negative and Positive Aspect of Air

Before Ionising the Air	***After Ionising the Air***
Ion imbalacing causes:	*Restoration of negative ions*
1. Fatigue	1. Eliminates fatigue
2. Emotional irritability	2. Enhances the feeling of well being
3. Inability to concentrate	3. Improves mental alertness
4. Insomnia	4. Inhibit bacterial growth

5. Depression	5. Helps people with respiratory ailments.
6. Higher sensitivity to allergens.	

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इंटरकॉम

छात्र : ललित कुमावत
अध्यापक : ओम प्रकाश पालीवाल

राजकीय गुरू गोविन्द सिंह
सीनियर सेकेन्डरी विद्यालय
उदयपुर (राजस्थान)

प्रस्तावना

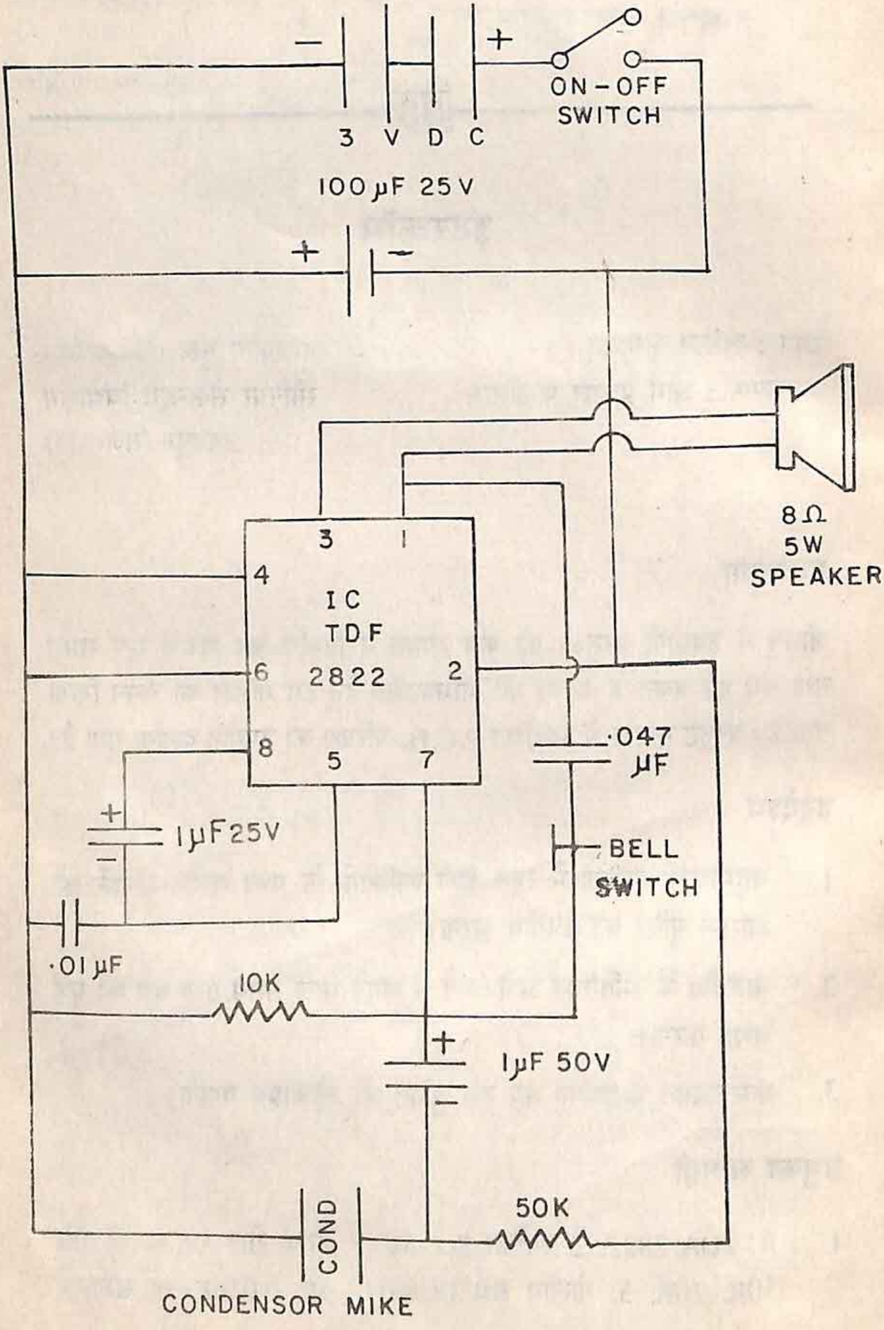
जीवन में उपयोगी वस्तुओं को कम लागत में निर्माण कर सकना एवं समय तथा श्रम की बचत के महत्व की अभिव्यक्ति हेतु इस मॉडल का चयन किया गया है। प्रस्तुत मॉडल में स्वरचित P.C.B. परिपथ का उपयोग दर्शाया गया है।

उद्देश्य

1. बहुमंजिली इमारतों में रहने वाले व्यक्तियों के मध्य सन्देश/सम्पर्क की आसान युक्ति का उपयोग करना।
2. बातचीत के अतिरिक्त आने-जाने में लगने वाले समय तथा श्रम की पूर्ण बचत करना।
3. कम लागत में निर्मित कर इस युक्ति को लोकप्रिय बनाना।

प्रयुक्त सामग्री

1. IC TDA 2822, 2. स्पीकर 8Ω, 5V, 3. शुष्क सेल 3V, 4. प्रतिरोध 50K, 10K, 5. गोलीय संधारित्र 0.047 μF, 0.01μF, 6. समान्तर



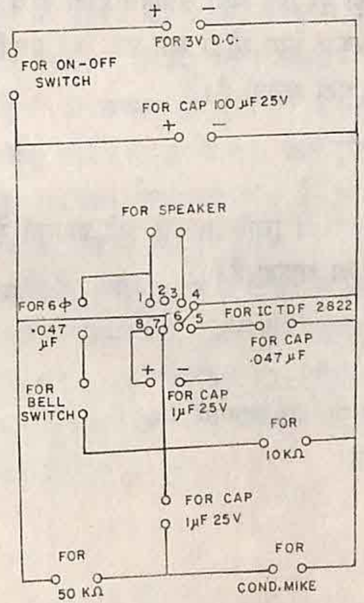
−
+
3 V D C
ON-OFF SWITCH
100 µF 25V
+
−
8 Ω
5W
SPEAKER
IC
TDF
2822
3
1
4
6
2
8
5
7
·047 µF
+
−
1µF25V
BELL SWITCH
·01 µF
10K
+
−
1µF 50V
COND
50K
CONDENSOR MIKE

पट्ट संधारित्र 1μF, 25V, 1μF, 50V; 100μF, 50V, 7. ध्वनिग्राही संधारित्र, 8. बेल स्विच, 9. प्रिंटेड परिपथ बोर्ड, 10. संयोजक तार।

अनुमानित लागत: रुपये 200 (लगभग)

कार्यकारी सिद्धान्त

यह उपकरण ध्वनि अर्थात् कम्पन पर आधारित है। इस उपकरण में जो कंडन्सर माइक उपयोग में लाया जाता है उसमें विशेष रूप से निर्मित कार्बन के छोटे-छोटे कण होते हैं। इन कणों के ऊपर एक धातु की पतली प्लेट होती है। जिसे डायफ्राम या प्रतन्तु कहते हैं। ध्वनि होने से जो कम्पन होती है उससे प्रतन्तु दब जाता है जिसके कारण कार्बन के कण बिखर जाते हैं। बिखरे हुए कार्बन के कणों से विद्युत धारा प्रवाहित नहीं हो सकती है। जब कार्बन के कण एकत्रित हो जाते हैं तब उनमें विद्युत धारा प्रवाहित हो सकती है। यह विद्युत धारा परिपथ के माध्यम से ध्वनि स्रोत तक पहुँच जाती है और कम्पन अर्थात् ध्वनि उत्पन्न होती है।



कार्य प्रणाली

जब हम कंडन्सर माइक पर बोलते हैं तो आज के कम्पन के कारण कार्बन के कण पास-पास आते हैं तथा तब जिस प्रकार की आवाज़ के कम्पन की तीव्रता थी उसी प्रकार विद्युत धारा प्रवाहित होती है और IC के जटिल परिपथ के कार्य करने पर स्पीकर में तरंगें पहुंचती हैं और स्पीकर में हमें ध्वनि सुनाई पड़ती है। IC को कार्य करने के लिए एक निश्चित विद्युत ऊर्जा की आवश्यकता होती है। अतः परिपथ में कुछ ओम के 2 प्रतिरोध तथा बहुत कम धारिता वाले संधारित्र उपयोग में लाए जाते हैं। परिपथ में लगे दो 1.5 वोल्ट वाले सेल से विद्युत ऊर्जा प्राप्त होती है (चित्र 1 तथा चित्र 2)।

उपकरण में घंटी बजना

इंटरकॉम में घंटी का होना आवश्यक है। इसे बजाने के लिए परिपथ में 1μF, 25V का संधारित्र उपयोग में लाया जाता है। सह संधारित्र विद्युत ऊर्जा ग्रहण करता है। तथा थोड़ी देर तक धारा संग्रहित होती है व पूर्व में संग्रहित आवेश निकलता है। इस प्रकार धारा थोड़ी रुक-रुक कर प्रवाहित होती है और उसी अनुसार स्पीकर में घंटी बजती है।

उपयोग

होटलों, स्कूलों, दफ्तरों व चिकित्सालयों की इमारतों में आपसी बातचीत के लिए प्रयुक्त किया जा सकता है।

संदर्भ

सर्किट इलेक्ट्रॉनिक प्रोजेक्ट-वाल्यूम 8
इलेक्ट्रॉनिक युक्तियाँ

34

रेलवे सुरक्षा यंत्र

छात्र : हेमा जायसवाल
अध्यापक : इन्दु शर्मा

क्रास्थवेट कन्या इन्टर कालेज,
इलाहाबाद, उत्तर प्रदेश

भूमिका

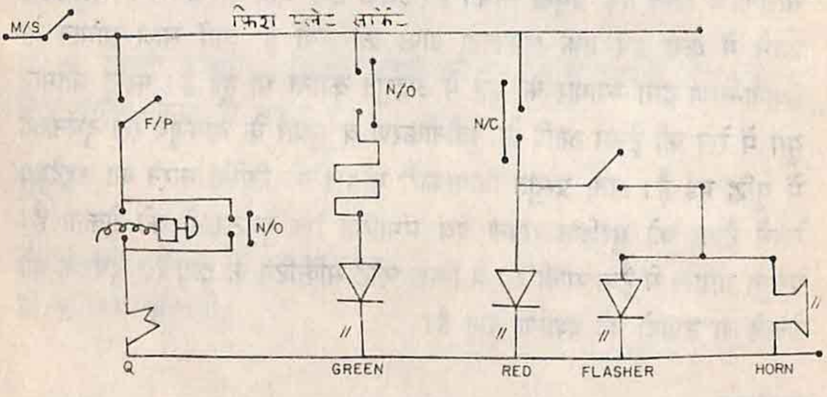
आज के जिज्ञासु मानव ने विकास के सोपानों पर चढ़ते हुए चन्द्रमा पर विजय प्राप्त कर ली है। इस भौतिकवादी युग में मानव की आवश्यकताओं की पूर्ति हेतु परिवहन एवं संचार के साधनों का अत्यन्त विकास हुआ है। इन साधनों के विकास के साथ-साथ इनकी सुरक्षा हेतु नवीन तकनीकों का आविष्कार एवं उपयोग करना भी अत्यन्त आवश्यक हो गया है। परिवहन एवं संचार के साधनों में रेलवे एक प्रमुख साधन है। इसके द्वारा जहाँ दूरियों पर विजय प्राप्त करने में कुछ हद तक सफलता प्राप्त की गयी है, वहीं साज-सामान के स्थानान्तरण द्वारा व्यापार के क्षेत्र में अद्भुत क्रान्ति भी हुई है। परन्तु वर्तमान युग में रेल की ट्रेक्स आदि के नवीनीकरण व सुधार के बावजूद रेल दुर्घनाओं में वृद्धि हुई है। अतः प्रस्तुत क्रियाकारी मॉडल को निर्मित करने का उद्देश्य रेलवे ट्रैक्स को सुरक्षित रखना एवं संभावित रेल दुर्घटनाओं को रोकना है। प्रस्तुत मॉडल में ट्रैक सर्किटिंग व फिश प्लेट सर्किटिंग के द्वारा रेल दुर्घटना को रोकने के उपायों को दर्शाया गया है।

उद्देश्य

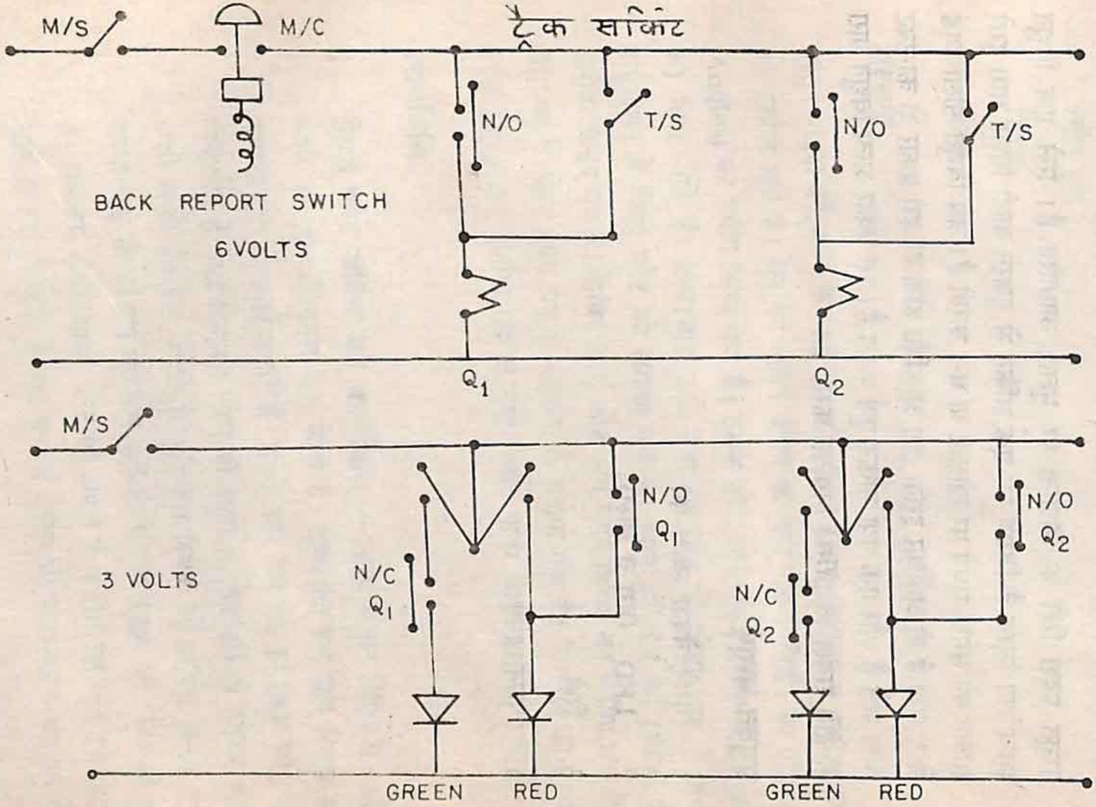
वर्तमान युग में कुछ अराजक तत्वों द्वारा रेल के जोड़ों पर लगी फिश प्लेट को

उखाड़ने व ढीली करने की घटनाएँ अक्सर प्रकाश में आती हैं। जिससे रेलगाड़ी पटरी से उतर जाती हैं तथा एक भयंकर दुर्घटना हो जाती है। प्रस्तुत मॉडल में यह दर्शाया गया है कि यदि कोई अवांछनीय तत्व इन्सुलेशन पर लगी फिश प्लेट को हटाता या ढीला करता है तो यदि सिग्नल हरे हैं तो लाल हो जाऐंगे तथा साथ में प्लैशर व हार्न भी कार्य करने लगेगा। इस प्रकार सिग्नल के संकेतों द्वारा चालक रेलगाड़ी को दुर्घटनास्थल पहुँचने से पहले रोक सकेगा। साथ ही हार्न के द्वारा केबिन मैन को यह पता चल जाएगा कि रेल के जोड़ों पर फिश प्लेट हटाई गई है। इस प्रकार से मॉडल में दर्शाई गई फ़िश प्लेट सर्किटिंग द्वारा रेल दुर्घटना को रोकने में सफलता प्राप्त की जा सकती है।

प्रस्तुत मॉडल में रेल दुर्घटनाओं को रोकने का एक अन्य उपाय ट्रैक सर्किटिंग द्वारा दर्शाया गया है। इसके अन्तर्गत यह दर्शाया गया है कि यदि कोई रेलगाड़ी ट्रैक पर खड़ी हुई है अथवा कोई अन्य प्रतिरोध ट्रैक पर रखा हुआ है तो, यदि केबिलमैन भूलवश या अन्य किसी कारण से सिगनल को हरा करना चाहेगा तो किसी भी अवस्था में सिगनल हरा नहीं होगा जब तक कि रेलगाड़ी उस खण्ड को पार न कर ले अथवा ट्रैक पर पड़े हुए अवरोधक को हटाया न जाए। अतः इस प्रकार से रेलगाड़ियों में होने वाली भिड़ंत को बचाकर रेल दुर्घटना को रोका जा सकता है।



अतः इस प्रकार से प्रस्तुत मॉडल के निर्माण का उद्देश्य रेल दुर्घनाओं को रोकना एवं रेल ट्रैक्स को सुरक्षित रखना है।


M/S
M/C
ट्रैक सर्किट
N/O
T/S
N/O
T/S
BACK REPORT SWITCH
6 VOLTS
Q1
Q2
M/S
N/O
Q1
N/O
Q2
3 VOLTS
N/C
Q1
N/C
Q2
GREEN
RED
GREEN
RED

वैज्ञानिक सिद्धान्त

प्रस्तुत प्रदर्श रिले के सिद्धान्त पर मूलतः आधारित है। रिले एक विद्युत स्वचालित स्विच है जिसमें कि एक सर्किट से गुजरने वाली विद्युत धारा दूसरे सर्किट को समय-समय पर खोलती या बन्द करती है। जब विद्युत सोलीनायड से गुजरती है तो आर्मेचार इसके द्वारा आकर्षित होता है। इस प्रकार दो कान्टेक्ट मिल जाते हैं और एक नया सर्किट पूर्ण करता है। इस प्रकार अल्प विद्युत धारा के द्वारा सबल विद्युत को नियंत्रित करता है।

प्रयुक्त वस्तुएँ

1. पुराने, बेकार स्केच-पेन
2. LED (हरा व लाल)
3. रिले
4. पुरानी दप्ती

5. पुराना बोर्ड
6. रंगीन तार
7. स्विच
8. बैटरी

संरचना

प्रस्तुत मॉडल को बनाने के लिए रेल की लाइन, केबिन, सिगनल व कंट्रोल रूप को दर्शाया गया है। रेल की लाइन बनाने के लिए एल्यूमिनियम के एंगिल्स (Angles) का प्रयोग किया गया है। उसके छोटे-छोटे टुकड़े (लगभग 20 cm के) किए जाते हैं। तत्पश्चात् उन्हें एक ही सीध में जोड़ा गया है तथा इन्सुलेशन में फिश प्लेट को लगाया गया है। पुराने टूटे बोर्ड की लकड़ी से स्लीपर बनाए गए हैं। केबिन कार्ड-बोर्ड और पुराने डिब्बों का बनाया गया है। सिगनल के पोस्ट स्केच पैन के आवरण से बनाया गया है। सिगनल को हरे व लाल LED द्वारा दर्शाया गया है तथा विद्युत पावर बैटरी द्वारा दी गयी है।

कार्यविधि

1. **फिश प्लेट सर्किट की कार्यविधि** – प्रारंभ में मेन स्विच को ऑन करने पर लाल सिगनल जल जाता है। तत्पश्चात् हम बेल स्विच को दबाकर हरा सिगनल जलाते हैं। उसके बाद हम जैसे ही फिश प्लेट को निकालते हैं, हरा सिगनल लाल हो जाता है तथा हार्न व प्लेशर कार्य करने लगते हैं। इस स्थिति में यदि हम स्विच को ऑपरेट करके हरा करना चाहें तो भी हरा सिगनल नहीं होगा चूंकि फिश प्लेट निकली हुई है। अब हम वापस फिश-प्लेट को लगाते हैं तो सिगनल यदि हरा करना चाहें तो हरा हो जाता है तथा हार्न व प्लैशर भी काम करना बंद कर देते हैं।
2. **ट्रैक सर्किट की कार्यविधि** – प्रारम्भ में हम दोनों मेन स्विच को ऑन करते हैं तत्पश्चात् रेलगाड़ी को ट्रैक पर चलाते हुए दिखाते हैं कि

जैसे ही रेलगाड़ी पहले इन्सुलेशन को पार करती है हरा सिगनल लाल हो जाता है तथा इसी प्रकार रेलगाड़ी जैसे ही दूसरे सिगनल को पार करती है, दूसरा सिगनल भी हरे से लाल हो जाता है अब गाड़ी ट्रैक को पार कर जाती है। यदि हम केबिल से सिगनल को वापस हरा करना चाहें तो सिगनल हरा नहीं होगा, जब तक कि रेलगाड़ी एक खण्ड को पार न कर जाए। जब रेल गाड़ी एक खण्ड को पार कर जाएगी तो कंट्रोल रूप में बैक रिपोर्ट स्विच को पुश करके छोड़ देने पर सिगनल को यदि हरा करना चाहेंगे तो सिगनल हरा हो जायेगा।

उपयोगिता

प्रस्तुत मॉडल का उपयोग रेलवे ट्रैक्स की सुरक्षा तथा रेल-दुर्घटनाओं को रोकने में किया जा सकता है। रेल दुर्घटनाओं से जहाँ अत्याधिक जन-धन की हानि होती है, वहीं यातायात भी बाधित हो जाता है, जिससे प्रति घंटे लाखों रूपये की हानि देश एवं रेल विभाग को होती है। अत: यदि प्रस्तुत मॉडल में दर्शायी गई फिश प्लेट सर्किटिंग व ट्रैक को व्यावहारिक रूप में अपनाया जाए तो प्रतिवर्ष दुर्घटनाओं से करोड़ों रूपयों की होने वाली हानि को बचाया जा सकता है। इसी राशि का उपयोग परिवहन प्रणाली को ओर उन्नत करने व ज्यादा से ज्यादा लोगों तक पहुँचाने में किया जा सकता है।

सहायक पत्रिका

इलेक्ट्रॉनिक्स फॉर यू, श्याम प्रोजेक्ट्स।

35

कुन्द-कुन्द रोबोट

छात्र : नितिन जैन
अध्यापक : ओम प्रकाश गोस्वामी

गोचर कृषि इन्टर कालेज, रामपुर
मनिहारन, सहारनपुर, उत्तर प्रदेश

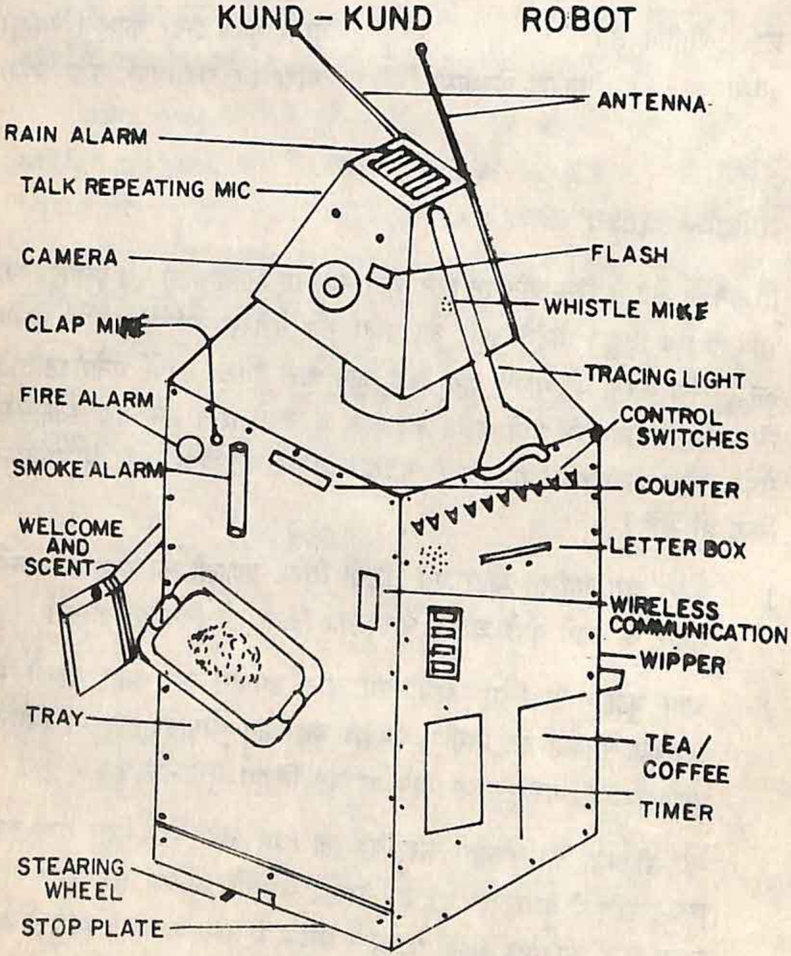
बौद्धिक उद्देश्य

विज्ञान के क्षेत्र में दिन-प्रतिदिन होने वाले नए-नए आविष्कारों एवं इलेक्ट्रॉनिक सर्किटों एवं विद्युत मोटरों आदि का प्रयोग कर ऐसे स्वचालित मशीनी मानव का निर्माण करना जो मानव द्वारा किए जाने वाले दैनिक कार्यों, मनोरंजन तथा भिन्न-भिन्न खतरों के प्रति सचेत कर सके व उनसे बचा सके तथा संक्रामक रोगों अथवा आण्विक विकिरण से पीड़ित रोगियों की सेवा आदि में उपयोगी सिद्ध हो सके।

1. बैटरी द्वारा चालित मोटर एवं रेडियो रिमोट प्रणाली का समायोजन कर रोबोट के आगे पीछे चलने, घूमने की क्रिया को नियंत्रित करना।
2. आग बुझाने के लिए जरमेनियम धातु उपयोग कर आग बुझाने में सहायक सर्किट का निर्माण करना। यह धातु सामान्य ताप पर विद्युत कुचालक है। परन्तु उच्च ताप पर यह विद्युत सुचालक है।
3. एल.डी.आर. का उपयोग कर विशेषता (यह अंधेरे में विद्युत सुचालक एवं प्रकाश में कुचालक है) का उपयोग कर चोर अलार्म, पत्र सूचना देने वाला यन्त्र, काउन्टर, धुआं, चेतावनी सूचक में अन्य उपयोगी सर्किटों का समायोजन कर उन्हें बनाया गया है।

निर्माण में प्रयुक्त वस्तुएँ

1. फाईबर शीट, 2. प्लास्टिक शीट, 3. विद्युत मोटर, 4. कैमरा, 5. पंखा, 6. जरमनियम डायाड, 7. एल.डी.आर., 8. आइ.सी., 9. टाजिस्टर, 10. कैपेसिटर, 11. रेजिस्टर, 12. टाईमर, 13. केतली, 14. स्विच, 15. तार, 16. पी.सी.बी., 17. एल्युमिनियम एगल, 18. पच, 19. स्पीकर, 20. भिन्न-भिन्न प्रकार की बैटरियाँ आदि।



संरचना एवं कार्य पद्धति

1. यह रोबोट एक मजबूत फाईबर शीट 41 से.मी. x 37 से.मी. आधार पर बनाया गया है। इसकी कुल ऊँचाई 85 से.मी. है। इसको चलाने के लिए शक्तिशाली 12-V (डी.सी.) मोटर के साथ रेडियो कन्ट्रोल स्विच द्वारा आगे-पीछे चलने की क्रिया को नियंत्रित किया गया है। घूमने, हाथ व गर्दन को चलाने, वाईपर, कैमरा को चलाने में भी अलग-अलग तरंग दैर्ध्य की रिमोट प्रणाली एवं मोटर का प्रयोग किया गया है।
2. एल.डी.आर. सर्किट का प्रयोग कर धूम्रपान वर्जित है, लेटर बाक्स, एल. डी.आर. सर्किट एवं धूम्रपान वर्जित के पिच का प्रयोग कर धुआं चेतावनी सूचक एल.डी.आर. सर्किट एवं काउन्टर का प्रयोग गणक में किया गया है।
3. जरमैनियम डायोड सर्किट का प्रयोग कर अग्नि चेतावनी सूचक एवं साथ में पंखे का प्रयोग कर आग बुझाने वाले यंत्र का निर्माण किया गया है।
4. जल के विद्युत सुचालक होने के गुण को प्रयोग कर वर्षा चेतावनी सूचक का निर्माण किया गया है।
5. क्लैप स्विच तथा हसंने की आवाज वाले चिप सर्किट का निर्माण एवं समायोजन किया गया है।
6. सीटी की तरंग दैर्ध्य पर आधारित सर्किट एवं अन्य चिप का समायोजन किया गया है।
7. इसी प्रकार विभिन्न इलेक्ट्रॉनिक सर्किटों एवं चिप एवं प्रकाश व्यवस्था को लगाया गया है।

उपयोगिता

1. प्रचलन—यह रोबोट चारों दिशाओं में (0°-360°) तक किसी भी दूरी से नियंत्रित प्रणाली द्वारा जा सकता है। नीचे कोई अवरोध आने पर स्वयं रुक जाता है। स्वतंत्र रूप से हाथ व गर्दन रिमोट कन्ट्रोल प्रणाली द्वारा

दूर से ही नियंत्रित किये जा सकते हैं। इस प्रकार इस रोबोट की सभी प्रमुख क्रियाएँ अलग-अलग तरंग-दैर्ध्य की रिमोट कन्ट्रोल प्रणाली से लगभग 10-15 मीटर की दूरी से नियंत्रित की जाती है।

2. लेटर बाक्स—इसमें लगे लेटर बाक्स में पत्र डालने पर यह पत्र आने की सूचना हमें तुरन्त देता है। इस प्रकार हमें डाकिये के आने के इंतजार से बचाता है।
3. वर्षा चेतावनी सूचक—वर्षा होने की स्थिति में यह हमें विशेष अलार्म बजाकर वर्षा होने की सूचना देता है।
4. अग्नि चेतावनी सूचक (फायर अलार्म)—आग लगने की स्थिति में यह हमें फायर अलार्म बजाकर सावधान करता है तथा इसमें लगाया गया पंखा स्वयं चलने लगता है। इसमें यदि पंखे के स्थान पर बड़ा अग्नि सामक लगा दिया जाए तो यह बड़ी आग को भी बुझा सकता है।
5. धुआं चेतावनी सूचक—सिगरेट या अन्य प्रकार का धुआं होने की स्थिति में यह अपनी स्वचालित प्रणाली द्वारा खांस कर "धूम्रपान वर्जित है" कहकर हमें धूम्रपान के प्रति सचेत करता है।
6. सुनी हुई बात को दोहराना—हमारे द्वारा इस रोबोट के सामने लगभग 10 मीटर तक की दूरी से की गई बात को भी यह दोहराता है तथा इस प्रकार हमारा मनोरंजन करता है।
7. काउन्टर—यह रोबोट एक बहुत ही अच्छा सुरक्षा गार्ड भी है। यह किसी भी प्रकार के समारोह आदि में प्रवेश द्वार पर खड़ा होकर अन्दर जाने वाले प्रत्येक व्यक्ति की सही गणना बोल कर बताता है तथा इसमें लगी स्क्रीन पर उसे प्रदर्शित करता है। रात में इस रोबोट को प्रवेश द्वार पर खड़ा कर देने पर यह रोबोट किसी भी व्यक्ति के अन्दर आने पर हमें अलार्म देता है। यदि इस रोबोट के हाथ में धातु डिटेक्टर दे दिया जाए तो यह किसी भी समारोह या अन्य स्थान में जाने वाले प्रत्येक व्यक्ति की चैकिंग भी कर सकता है। इसका उपयोग सेना में भी किया जा

सकता है। इसमें विस्फोटक पदार्थ रखकर रोबों को इसी दूर से नियंत्रित प्रणाली द्वारा दुश्मन के क्षेत्र में ले जाकर विस्फोट कर देने पर यह दुश्मन के महत्त्वपूर्ण ठिकानों को नष्ट कर सकता है।

8. चोट से रोना—आप के द्वारा सिर पर चोट पहुँचाने पर यह रोबोट रोने लगता है।

9. ताली बजाने पर हंसना—यदि आप इस रोबोट के सामने ताली बजायेंगे तो यह हंसने लगता है।

10. स्वागतम्—हाथ मिलाने पर यह रोबोट आपके स्वागत में आप पर सेंट छिड़कता है। और आपको "मैं आपकी क्या सहायता कर सकता हूँ ?" कहता है।

11. घरेलू सहायक—यह एक अच्छा घरेलू सहायक भी है। घर में सफाई व पानी द्वारा पोचा भी रिमोट कन्ट्रोल प्रणाली द्वारा लगाता है। इस प्रकार सफाई करने के लिए अस्पतालों आदि में साफ-सफाई कर एवं रोगनाशक दवायें छिड़ककर मरीज की सेवा कर सकता है।

12. संदेश वाहक—यह रोबोट केबिन में बैठे डाक्टर की बातचीत लगगभग 30 मीटर की दूरी से बेड पर पड़े मरीज से कराने में सक्षम है।

13. रसोई सहायक—यह रोबोट आपके द्वारा इच्छित समय पर चाय या कॉफी बनाकर आपको देगा।

14. फोटोग्राफर—यह रोबो अपने सिर में लगे कैमरे द्वारा किसी भी कोने, दुर्गम स्थान जहाँ मानव द्वारा फोटो खींचना संभव नहीं है, अपनी अलग रिमोट कन्ट्रोल प्रणाली द्वारा किसी भी कोण से फोटो खींचता है।

15. जासूसी—यह दुश्मन के इलाके या अन्य किसी स्थान पर होने वाली गुप्त वार्तालाप को एक प्रकार की रेडियो तरंगों द्वारा हमें सुनाता है। यह एक अच्छा गुप्तचर भी है। इसमें अपने इस्तेमाल के अनुसार छोटे-छोटे परिवर्तन कर इसके उपयोगों को आवश्यकतानुसार बहुत अधिक विकसित किया जा सकता है।

विशेष

यह रोबो एक अच्छा खासा आकर्षण का केन्द्र भी है। अपनी सुन्दर प्रकाश व्यवस्था एवं अपनी सुन्दर मानव आकृति के कारण यह सबको आकर्षित कर मनोरंजन करता है। इस रोबों का नाम कुन्द-कुन्द आचार्य के सम्मान में रखा गया है जो कि आज से लगभग 1900 वर्ष पूर्व भारत के एक महान दार्शनिक होने के साथ ही साथ एक महान वैज्ञानिक भी थे।

सहायक पुस्तकें तथा पत्रिकाएँ

विज्ञान प्रगति, इलेक्ट्रॉनिक पाइंट, इलेक्ट्रॉनिक्स फॉर यू, इलेक्ट्रोनिक प्रोजेक्ट्स, आप्टो इलेक्ट्रॉनिक्स सर्किट मैनुअल, आदि।

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आप्टिकल कम्युनिकेशन

छात्र : भवानी सिन्हा
सोनी कुमारी
रिमझिम कुमारी
अध्यापक : तारकेश्वर प्र. सिंह
डा. सुरेश प्र. राय

ओमर बालिका उच्च विद्यालय
विष्णुपुर, बेगुसराय, बिहार

भूमिका

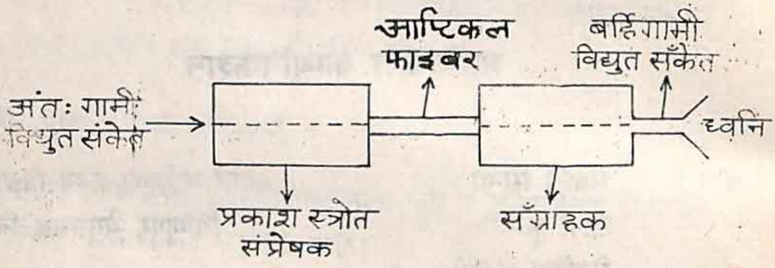
प्रकाश तंत्र ही अकेली ऐसी युक्ति है जिसके द्वारा प्रकाश संकेत को प्रेषित से संग्राहक तक बिना किसी क्षति के लम्बी दूरी तक लाया जाता है। प्रकाश तन्तु शुद्धतम सिलिकान आक्साइड के बने होते हैं। इसका रिफ्रेक्टिव इन्डेक्स बदलने के लिए थोड़ी मात्रा में जरमेनियम या बोरान मिला दिया जाता है। इनमें संकेत क्षति अति सूक्ष्म होती है। प्रस्तुत प्रदर्श में यह दिखाया गया है कि किस प्रकार से प्रकाश के द्वारा ध्वनि का संप्रेषण होता है।

वैज्ञानिक सिद्धांत

प्रकाश तन्तु पूर्ण आन्तरिक परावर्तन के सिद्धांत पर प्रकाश को सीधी रेखा में निर्देशित करता है। सर्वप्रथम प्रेषित विद्युत संकेतों को प्रकाश में परिवर्तित किया जाता है। प्रेषित में प्रविष्ट होने वाली विद्युत धारा के प्रकार और मात्रा पर ही इससे निकलने वाले प्रकाश की प्रकृति निर्भर करती है। प्रकाश संकेतों को

पकाश तन्त (Optical fibre) म निदशित किया जाता ह। अब दसुरी इलक्टानिक युक्तियों के द्वारा प्रकाश से विद्युत एवं विद्युत से ध्वनि सुनी जाती है।

बनावट



कार्यविधि

सर्वप्रथम ध्वनि संकेतों के द्वारा प्रकाश उत्पन्न किया जाता है। प्रकाश स्रोत से प्रकाश तन्तु के द्वारा संग्राहक में लाया जाता है जहाँ पर पुनः विद्युत से ध्वनि उत्पन्न होती है। यह संकेत टेलीफोन जैसे इलेक्ट्रॉनिक उपकरण को सीधे भेजे जा सकते हैं, जबकि टेलीविजन संकेत की स्थिति में इनकी डिकोडिंग की आवश्यकता होती है।

प्रकाश तन्तु में एक डेसीबल की क्षति को 20% क्षति माना जाता है। यानि किसी बिन्दु पर यदि एक डेसीबल की क्षति मापी गई तो इसका अर्थ यह है कि 80% संकेत वहाँ मौजूद हैं। 1300 नैनोमीटर के तरंग दैर्ध्य पर प्रति किलोमीटर आधे डेसिबल ध्वनि संकेत की क्षति होती है। 1550 नैनोमीटर के तरंगदैर्ध्य पर प्रति किलोमीटर एक चौथाई डेसिबल का पांच प्रतिशत संकेत क्षति होती है।

तरंग दैर्ध्य	दूरी (ध्वनि संकेत)
1300 नैनोमीटर	50 से 60 किलोमीटर
1500 नैनोमीटर	120 से 150 किलोमीटर

विशेषता

1. ये इलेक्ट्रॉनिक संकेतों के बदले प्रकाश का परिवहन करते हैं।
2. बिजली गिरने से क्षतिग्रस्त नहीं होता है।
3. विद्युत चुम्बकीय क्षेत्र का इस यंत्र पर (Optical fibre) से निर्मित कोई प्रभाव नहीं पड़ता है।
4. उँचें वोल्टेज से मुक्त होता है।
5. कारों के स्पार्क प्लग से कोई व्यवधान उत्पन्न नहीं होता।

उपयोग

1. सर्वाधिक उपयोग दूरसंचार के क्षेत्र में हो रहा है।
2. ऐसी भविष्यवाणी की जा रही है कि शायद जल्दी ही फाइबर आप्टिक्स उपग्रह दूरसंचार की जगह ले ले।
3. टेलीफोन केबल में
4. डिजिटल डेटा में
5. स्टीरियोफोनिक संगीत में
6. इसमें लागत खर्च 90 रुपए मात्र है।

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पैडी थ्रेशर

छात्र : श्वेता मेहेर
अध्यापक : शकुन्तला सक्सेना

राजकीय कन्या इन्टर कालेज
पौड़ी, उत्तर प्रदेश

उद्देश्य

विद्युत मोटर चालित पैडी थ्रेशर के आधार पर प्रोटोटाइप कम लागत का पोर्टेबल विद्युत मोटर चालित थ्रेशर बनाया जा सकता है। इससे गरीब किसानों द्वारा खेत में पड़े लांक के पास (ढुलाई की बचत) ही मशीन ले जाकर अनाज की मढ़ाई कम समय में मितव्ययतापूर्वक की जा सकती है।

वैज्ञानिक सिद्धांत

विद्युत ऊर्जा को विद्युत मोटर द्वारा यान्त्रिक ऊर्जा में परिवर्तित कर थ्रेशर को चलाया गया है।

निर्माण में प्रयुक्त वस्तुएँ

1. पोर्टेबल ट्राली के लिए—25 cm × 20 cm का लकड़ी का एक बोर्ड, पहियों के लिए चार वाशर, धुरों के लिये कीलें एवं एक हुक।
2. विद्युत मोटर के लिए—18 cm लम्बी दो कीलें (एक सीधी शाफ्ट के लिए तथा एक U-आकार में विद्युत चुम्बक के लिए), 6 cm लम्बी चार कीलें (नर्म दण्ड के लिए), 8 cm लम्बी तथा 1 cm चौड़ी दो

पत्तियाँ (आर्मेचर शाफ्ट को घुमाने वाली एक्सल से संपर्क के लिए), इनेमिल चढ़े 24 नं. की तार की एक रील, इन्सुलेटिड टेप की एक रील, एक स्विच तथा 1 cm लम्बे स्टील के चार पेंच, विद्युत शक्ति के लिए 12 वोल्ट व 1.5 एम्पीयर का एक ए.सी. से डी.सी. कन्वर्टर।

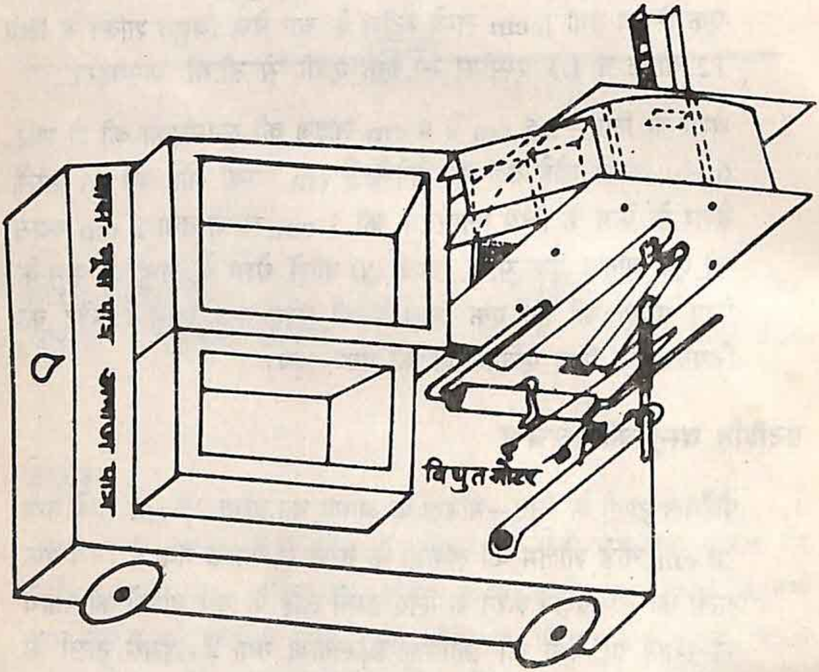
3. थ्रेशर के लिए—8.5 cm × 9 cm साइज की सनमाइका की दो शीट, 6 cm लम्बी लोहे की आठ कीलें, 3 cm लम्बी लोहे की 16 कीलें, थ्रेशर के फ्रेम के लिये प्लास्टिक की 3 cm लम्बी तथा 2 cm व्यास की एक बोतल, एक से.मी. लम्बी 20 कीलें, थ्रेशर के अन्दर के ड्रम के लिए प्रयोग की हुई एक एक्स-रे की प्लेट तथा एक्स-रे प्लेट को चिपकाने के लिए फेवीक्विक की एक ट्यूब।

प्रदर्शित वस्तु की संरचना

1. पोर्टेबल ट्राली के लिए—मॉडल के आधार का ढांचा 25 cm लम्बे तथा 20 cm चौड़े शीशम की लकड़ी के तख्ते से बनाया गया है जिसे एक ट्राली का रूप प्रदान करने के लिए उसमें लोहे के चार वाशरों को पहियें को स्थान पर पेंचों की सहायता से लगाया गया है। इससे ट्राली के सुविधापूर्वक इधर-उधर आसानी से ले जाया जा सकता है।

2. आर्मेचर—आर्मेचर शाफ्ट के लिए 18 cm लम्बी कील पर 4 cm तक की चौड़ी टेप की दोहरी तह लपेट कर ढक दिया है। आर्मेचर के गर्मदण्ड के लिए 6 cm लम्बी दो कीलों का एक जोड़ा लेकर उन्हें उल्टे क्रम में एक दूसरे के साथ सटाकर उन पर टेप चढ़ा दिया है तथा कीलों के एक अन्य जोड़े के साथ भी यही किया गया है। शाफ्ट वाली कील के एक सिरे से कुछ दूरी पर दोनों ओर नर्मदण्ड के दोनों जोड़ों को सटाकर टेप को नर्मदण्ड के ऊपर दो बार लपेटकर शाफ्ट को नर्मदण्ड पर अच्छी तरह जमाया गया है। अब आर्मेचर पर 24 नं. का इनेमिल चढ़ा तार लगभग 15 cm सिरा खाली छोड़ते हुये बीच से एक किनारे तक फिर लौटाकर बीच तक, फिर बीच से दूसरे सिरे तक, फिर लौटकर

दूसरे सिरे तक एक ही दिशा में लपेटा गया है, तथा तार का दूसरा सिरा भी 15 cm खाली छोड़ गया है।



3. दिशा परिवर्तक—दिशा परिवर्तक बनाने के लिये आर्मेचर पर लिपटे दोनों सिरों के तार का इनेमिल खुरचकर जिगजेग शक्ल में मोड़कर शाफ्ट कील पर मुड़े हुये तार के दोनों सिरों को लगाकर बीच के भाग को खाली छोड़कर बाकी दोनों ओर टेप लगाया गया है।

4. विद्युत चुम्बक—विद्युत चुम्बक बनाने के लिए 18 cm लम्बी कील को U-आकार में इस प्रकार मोड़ा गया है कि लम्बवत दोनों भुजाओं के बीच की दूरी लगभग 8 cm रहे। फिर उसके बीच के भाग पर दो तह में टेप लपेटा गया है। टेप के ऊपर 24 नं. का तार एक ही दिशा में इस प्रकार लपेटा गया है कि लगभग 400 चक्कर हो जायें। इसके बाद इसे

लकड़ी के बोर्ड पर इसकी लम्बवत भुजाओं को ऊपर की ओर सीधा रखकर कसा गया है। 8 cm तथा 1 cm चौड़ी दो पत्तियों के दोनों सिरों पर एक-एक छेद किया गया है तथा इन्हें लकड़ी के आधार पर स्टील की दो पेंचों की सहायता से लम्बवत् ऐसे स्थान पर जोड़ा गया है कि इनके ऊपरी सिरों वाले छेदों में आर्मेचर की शाफ्ट विद्युत चुम्बक के बीचों बीच रहकर घूम सके।

5. बुश—15 cm लम्बे तार के दो टुकड़े लेकर उन्हें लकड़ी की तख्ती में छेद करके क्रमशः शाफ्ट के दोनों ओर इस प्रकार जोड़ा गया है कि यह दिशा परिवर्तक को छूते रहकर बुश का काम करें। अब बुश के एक तार को चुम्कब की कुण्डली के एक सिरे से जोड़ दिया गया है तथा इस कुण्डली के दूसरे सिरे के तार को स्विच के एक सिरे से जोड़कर स्विच के दूसरे सिरे को डी.सी. विद्युत. सप्लाई के धनात्मक सिरे पर तथा ऋणात्मक सिरे को दूसरे बुश के साथ जोड़ दिया गया है।

6. थ्रेशर बनाने के लिए—थ्रेशर के अन्दर का कटर तथा पंखा युक्त रोलर प्लास्टिक की शीशी को काटकर उसमें कीलें गाड़कर बनाया गया है जिसे सीधे मोटर शाफ्ट पर लगाया गया है जिससे ऊर्जा सीधे इसे घुमाने में बिना किसी बर्बादी के प्रयोग हो सके। बाहरी ढांचा सनमाइका शीट के 8.5 cm × 9.5 cm चौकोर टुकड़ों पर एक सिलेण्डर की शक्ल देने के लिये 4 cm चौड़ी तथा 18 cm लम्बी उपयोग की गई एक्स-रे प्लेट को फेवीक्विक से चिपकाकर बनाया गया है। इसमें लॉक डालने के लिये एक पतनाला तथा भूसा निकालने के लिए एक पतनाला भी एक्स-रे प्लेट के टुकड़ों को चिपकाकर ही बनाया गया है। अनाज के दानों को निकालने के लिए इस सिलेण्डर के नीचे तारों की जाली की छलनी बनाकर लगाई गई है। इस ढाँचे का आधार तख्ती पर सीधा रखने के लिये 8 cm लम्बें तथा 1 cm × 1 cm क्रास सैक्शन के लकड़ी के दो टुकड़ों को ट्राली पर चिपकाकर बनाया गया है।

कार्यपद्धति

तार की एक कुण्डली यदि विद्युत चुम्बक के सिरों के बीच रखी हो और कुण्डली में से विद्युत धारा प्रवाहित की जाये तो कुण्डली अपने अक्ष के गिर्द घूमने लगती है। इस प्रकार विद्युत ऊर्जा को यान्त्रिक ऊर्जा में बदलकर इसे थ्रेशर को चलाने में उपयोग किया गया है। थ्रेशर के कटर तथा पंखायुक्त सिलेण्डर के घूमने से अनाज के दाने पुआल से अलग हो जाते हैं।

प्रदर्श की उपयोगिता

इससे गरीब किसानों द्वारा खेत में पड़े लांक के पास ही (ढुलाई की बचत) मशीन ले जाकर अनाज की मड़ाई कम समय में मितव्ययतापूर्वक की जा सकती है।

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जल शुद्धिकरण एवं प्रबंधन

छात्र : मनस्वी दीक्षित
अध्यापक : बजरंग लाल सोनी

सेठ सम्पतराम जो दूगड़ उच्च
माध्यमिक विद्यालय, सरदार शहर
जिला-चूरू (राजस्थान)

भूमिका

मानव ही नहीं अपितु सजीवों के अस्तित्व का मूल आधार जल ही है। भूमण्डलीय रचनाओं तथा अन्य प्राकृतिक संरचनाओं की विभिन्नता होने के कारण जल की मात्रा में असमानता है। जल की अधिकाधिक अथवा न्यूनतम मात्रा में भी वितरण की सुचारू व्यवस्था होनी आवश्यक है।

उद्देश्य

जल का अभाव राजस्थान जैसे भूभाग में हमेशा से ही रहता आया है जिससे जीवन के हर क्षेत्र में कमी अखरती रहती है। चाहे पीने के पानी की हो या कृषि में सिंचाई के जल की, परन्तु यदि जल की उपलब्ध मात्रा में वितरण व्यवस्था सही रखें तो प्राप्त स्रोतों से ही जल का उचित उपभोग होगा और कमी का आभास नहीं होगा। इन्हीं बिन्दुओं को दृष्टिगत रखते हुए इस प्रयोग को क्रियान्वित करने का प्रयास किया गया है।

प्रस्तुत प्रयोग में तालाब, नहर अथवा नदी के साधारण दृष्टिगत जल को भी पीने के पानी में परिवर्तित कर उसे शहरी अथवा ग्रामीण क्षेत्र में आधुनिक

युग के उपलब्ध साधनों का समुचित प्रयोग करते हुए वितरण व्यवस्था को स्वचालित किया गया है।

वर्णन

यह प्रयोग दो भागों में विभक्त है :

(अ) नदी, तालाब अथवा नहर के पानी को पीने योग्य बनाने का संयन्त्र, (ग्रामीण क्षेत्र हेतु)

(ब) स्वच्छ जल की इलेक्ट्रॉनिक विधि से वितरण तथा शुद्धिकरण व्यवस्था (शहरी क्षेत्र हेतु)

प्रयोग के प्रथम भाग में निम्न उप-भाग बनाये गये हैं :

1. निधारक टैंक
2. फिटकरी घोल टैंक
3. मिश्रण व पुनः निधारक टैंक
4. फिल्टर टैंक
5. क्लोरीन टैंक व अल्ट्रावायलेट रेंज़ कक्ष
6. पम्पिंग सैक्शन तथा वाटर टैंक

1. सूक्ष्म माजिक तत्वों की समाविष्टता
    - (अ) लोहा, तांबा, के आयन हेतु पात्र निर्माण
    - (ब) चाँदी के आयन हेतु त्वरित उपकरण
2. जल शुद्धिकरण के वैज्ञानिक तथ्यों में अभिनव इलेक्ट्रॉनिक युक्तियाँ .
    - (अ) सूक्ष्म तरंगों द्वारा यौगिक विभक्त प्रणाली
    - (ब) पराबैंगनी किरणों द्वारा जीवाणु मुक्त करना
3. जल वितरण एवं रखरखाव तथा प्राकृतिक संसाधन रक्षण हेतु वैज्ञानिक सोच व निराकरण।
    - (अ) इलेक्ट्रानिकी व्यवस्थाओं द्वारा समयानुसार जल वितरण हेतु आधुनिक इलेक्ट्रॉनिक वाल्व

(ब) सार्वजनिक स्थानों पर जल का अपव्यय रोकने हेतु स्वचालित वाटर टैप प्रणाली।

(स) जल स्तर बनाये रखने हेतु अपशिष्ट जल का पृथ्वी गर्भ में पुनः भण्डारण व्यवस्था की परिकल्पना तथा सकारात्मक व्यावहारिक उपाय।

4. जल की स्वच्छता बनाये रखने हेतु उपाय

(अ) ग्रामीण क्षेत्रों में सार्वजनिक स्तर पर

(ब) ग्रामीण क्षेत्रों में व्यक्तिगत स्तर पर

(स) औद्योगिक अपशिष्ट जल का शुद्धिकरण।

विधि

सर्वप्रथम नहर का पानी निधारक टैंक में प्रवेश करता है। यह निधारक टैंक तीनों भागों में बंटा है (चित्र)। इसके प्रथम भाग में नहर से आए पानी के साथ पत्थर, लकड़ी, व कचरा अलग हो जाता है और फिर पानी इसी निधारक टैंक के दूसरे भाग में प्रवेश करता है। इस भाग में छोटे पत्थर व रेत तथा बारीक किस्म का कचरा अलग होकर इसी निधारक टैंक के तीसरे उप-भाग में प्रवेश करता हुआ पाईपों द्वारा तीसरे नम्बर के मिश्रण व पुनः निधारक टैंक में जाता रहता है।

जब जल प्रथम टैंक से तीसरे टैंक में प्रवेश करता है उस समय उसमें दूसरे नम्बर के टैंक से फिटकरी का घोल शनै-शनै मिलता रहता है जिससे तीसरे मिश्रित टैंक में फिटकरी मिले पानी का जमाव होता रहता है। यह मिश्रित व पुनः निधारक टैंक तल को निथार कर प्रथम टैंक से आये कठोर किस्म के जल को मृदु जल में बदलकर प्रयोग के चौथे भाग में स्थित फिल्टर टैंक में भेजता है। फिल्टर टैंक में उपस्थित कोयला तथा बालू रेत की विभिन्न परतों से पानी की अघुलनशील अशुद्धियाँ छन जाती हैं और अब पानी प्रयोग के पाँचवें भाग या कि अल्ट्रावायलेट रेंज़ तथा क्लोरीन गैस वाले भाग में प्रवेश करता है। इस भाग में पानी के प्रवाह पर हल्की अल्ट्रावायलेट रेंज़ की बौछार

के साथ-साथ उचित मात्रा में क्लोरीन मिलाई जाती है। इन दोनों के संयुक्त प्रभाव से पानी कीटाणु-रहित तथा पूर्ण रूप से स्वच्छ होकर हौज में इकट्ठा हो जाता है। क्लोरीन तथा अल्ट्रावायलेट रेज़ कक्ष पूर्णतः इलेक्ट्रॉनिक विधि द्वारा नियंत्रित कक्ष है। पानी की मात्रा के अनुकूल ही अल्ट्रावायलेट रेज़ की सघनता होगी अथवा क्लोरीन की मात्रा उसी अनुपात में मिलाई जाती है जिससे दोनों के हानिकारक प्रभावों की आशंका नहीं रहती।

हौज में एकत्रित स्वच्छ जल को पम्पसैट द्वारा ओवरहैड टैंक में भर दिया जाएगा। यह पम्प सैट भी स्वचालित है। जब ओवरहैड टैंक एक निश्चित जल-स्तर तक खाली होगा तब पम्प सेट स्वतः चालु होगा और जब वाटर टैंक भर जायेगा तो पम्पसैट स्वतः ही बन्द हो जायेगा। यह व्यवस्था इलेक्ट्रॉनिक सर्किट से की गई है। वाटर टैंक से पानी उपभोक्ताओं को पहुँचाया जायेगा। उपभोग किये जाने वाले पानी के निकास की व्यवस्था भी इस प्रयोग में स्वचालित की गई है जो कि इलेक्ट्रॉनिक टाइमर सर्किट से जुड़ी हुई है।

इस प्रकार नहर के अस्वच्छ, कठोर तथा कीटाणुयुक्त जल को स्वच्छ, मृदु तथा कीटाणु-रहित पीने योग्य जल बनाने की सम्पूर्ण क्रिया इस प्रयोग में कार्यरत रूप में दर्शाई गई है। साथ ही साथ वितरण व अन्य सभी क्रियाओं का संचालन मानव रहित स्वचालित प्रणाली द्वारा इलेक्ट्रॉनिक्स के आधार पर किया गया है। इस प्रयोग के द्वितीय भाग में निम्न क्रियाएँ हैं :

1. क्लोरीन तथा इस जल को अल्ट्रावायलेट रेंज़ के सामने एक्सपोज करने की क्रिया पर नियंत्रण हेतु।
2. पम्प से हौज भरने हेतु (प्रोबसैंसिंग इलेक्ट्रॉनिक सर्किट)।
3. वाटर टैंकों का जल वितरण हेतु टाइमर सर्किट व सिंचाई हेतु इलेक्ट्रॉनिक सर्किट।

शहरी क्षेत्र हेतु जल को कीटाणु-रहित करने की विधियाँ :

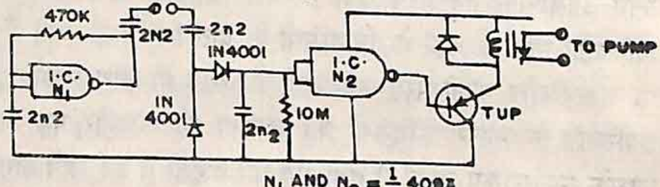
1. माइक्रोवेव प्रणाली द्वारा फ्लुओराइड की मात्रा को कम करना। कई स्थानों जैसे राजस्थान, गुजरात, मध्य प्रदेश आदि में प्राप्त होने वाले जल में फ्लुओराइड तथा अन्य हानिकारक रासायनिक यौगिकों की मात्रा अधिक

होती है। इस स्थिति में जल को सम्पूर्ण रूप से शुद्ध करना स्वास्थ्य के लिए आवश्यक है। जिन क्षेत्रों में जल में प्लुओराइड की मात्रा की अधिकता होती है वहाँ के निवासियों के दाँत विकृत हो जाते हैं। दाँतों पर एक विशेष पीली परत जम जाती है। साथ ही साथ प्लुओराइड की उपस्थिति के कारण हड्डियों की संरचना भी कमज़ोर पड़ जाती है जिसके फलस्वरूप जोड़ों में तथा रीढ़ की हड्डी में दर्द रहने लगता है। अतः यह आवश्यक है कि पानी से प्लुओराइड को दूर करने का कोई सरल व घरेलू उपाय सुझाया जाये। इस तथ्य को ध्यान में रखकर एक अत्यन्त साधारण तथा रखरखाव-मुक्त कम खर्चीला पोर्टेबल उपकरण तैयार किया गया है जिसका उपयोग घरेलू स्तर पर हर घर या व्यक्ति कर सकता है। यह एक अत्यन्त सरल एकल ट्रांजिस्टर का ओसीलेटर सर्किट है जो पेन के आकार जितना है। इस सर्किट को 39 डी.सी. करेन्ट से ओपरेट् किया जा सकता है। पानी में इस उपकरण के प्लास्टिक भाग को रखकर 1 मिनट के लिए (एक लीटर पानी हेतु) स्विच आन करते हैं। सर्किट में विद्युत प्रवाह होने से इसमें से तीव्र शॉर्टवेव तरंगें ओसीलेटर द्वारा निकलती हैं जो पानी की आणविक संरचनाओं को उसी आवृति में कथल करवाती हैं जिससे वे कम ऊर्जा प्राप्त कर टूट जाते हैं तथा धनात्मक व ऋणात्मक आयनों में बंट कर अपनी मूल संरचना को नष्ट कर देते हैं। इससे पानी में घुले अन्य रासायनिक यौगिक जैसे कैल्शियम, मैग्नीशियम तथा सोडियम के प्लुओंराइड सल्फेट व कार्बोनेट विभक्त होकर अन्य सरल अणुओं में बंट कर जल में अपना प्रभाव नहीं बना पाते हैं। इस प्रकार, जल इन जटिल रासायनिक अणुओं से मुक्त होकर हानिकारक प्रभावों से रहित हो जाता है।

2. कॉपर, सिल्वर तथा आयरन के आयनों को समाविष्ट करना।

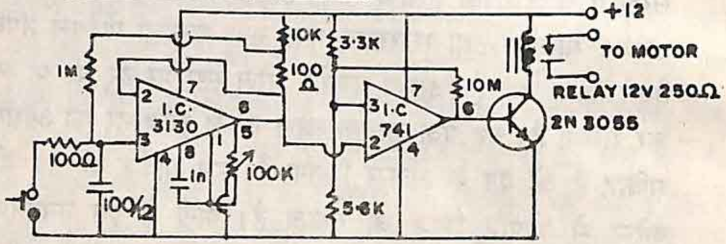
शरीर का सूक्ष्मात्रिक तत्वों की विभिन्न हारमोन्स संचालक व एन्जाइमों की विभिन्न प्रक्रियाओं के संचालन हेतु आवश्यक होती है। प्राचीन ग्रन्थों व आयुर्वेद में जल को तांबे व चाँदी के पात्रों में रखने का सुझाव इसी उद्देश्य

(1) LIQUID LEVEL SENSOR

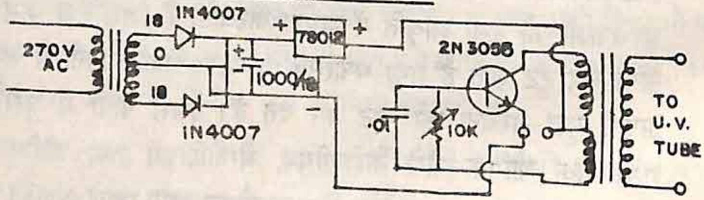


N_1 AND $N_2 = \frac{1}{2}$ 4093

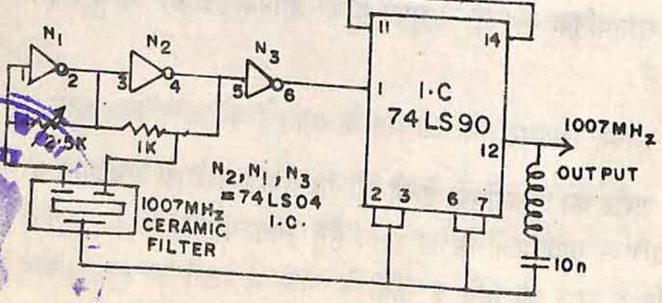
(2) LONG INTERVAL TIMER



(3) U.V. TUBE AND POWER SUPPLY



(4) SHORT WAVE CIRCUIT



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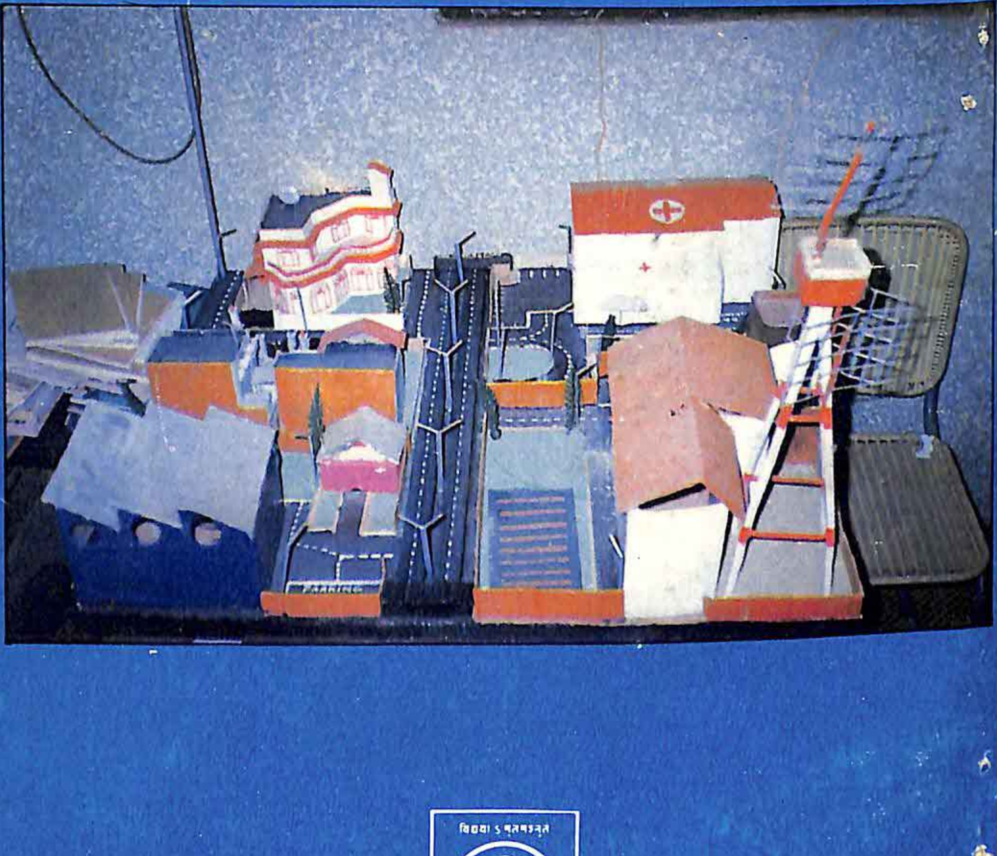
हेतु किया गया है। तांबे व चाँदी के पात्रों में पानी जब अधिक देर तक रखा जाता है तो इन धातुओं की सूक्ष्म मात्रा पानी में मिलकर पानी को कीटाणु मुक्त तो करती ही है साथ ही शरीर की आवश्यक सूक्ष्मामत्रिक तत्वों की पूर्ति करने में भी सहायक होती है। इस प्रकार की क्रियाओं को पूरा करने हेतु पानी को 12 से 24 घंटे तक पात्रों में रखना पड़ता है परन्तु आज की व्यस्त जीवन शैली में इतना इन्तजार संभव प्रतीत नहीं होता। इसी उद्देश्य से इस प्रदर्श में इस विधि का प्रयोग किया गया है। इस विधि में एक ही कुचालक पात्र में दो ताँबे तथा दो लोहे तथा दो चाँदी की छड़ें व्यवस्थित की गई हैं। छड़ों का सम्बन्ध एक साधारण ट्राजिस्टराइज्ड रिपल ओसीलेशन सर्किट से जोड़कर 1.5 वी.डी.सी. (एक पेन लाइट सैल) ऑन रखा जाता है। तीनों धातुओं के इलेक्ट्रोडों के चारों ओर पानी में जब रिपल ओसीलेशन केवल लोहा, ताँबा व चाँदी के इलेक्ट्रोडों द्वारा मिलती है तो पानी में इन धातुओं के आयन मिलते रहते हैं जिससे उपरोक्त पूर्तियाँ पानी में होती रहती हैं। यह सम्पूर्ण सर्किट मात्र रूपये 20-25 में ही तैयार किया जा सकता है। (इलेक्ट्रोडों को छोड़कर) तथा हर व्यक्ति के उपयोग हेतु सुगम है। (चित्र 1-4)

आवश्यक सामग्री

1. प्लास्टिक वर्तन-आठ, 2. प्लास्टिक पाइप, 3. पानी का हस्तनिर्मित पम्प, 4. विद्युत मोटर, 5. लकड़ी का बोर्ड, 6. रेत, 7. कोयला, 8. बजरी, 9. क्लोरीन, 10. फिटकरी, 11. इलेक्ट्रॉनिक सर्किट में प्रयुक्त ट्रांजिस्टर कन्डैन्सर, रजिस्टेन्स, 12. UU ट्यूब, 13. ट्रांसफार्मर, 14. तार, आदि।

निर्देशन

1. स्ट्रक्चर एण्ड वर्किगं ऑफ साइंस माडल्स-1984, 1990, 1993-94, एन.सी.ई.आर.टी. द्वारा प्रकाशित।
2. 101 प्रोजेक्ट ऑफ प्रैक्टिकल्स-1995
3. भारत ज्ञान विज्ञान समिति द्वारा प्रकाशित पुस्तकें।
4. समाचार पत्रों के विज्ञान सम्बन्धी निबन्ध।



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